

Exploratory Correlation Analysis of Multi-site Summer Temperature and Flow Data in the Fraser River Basin

M.J. Hague, D.A. Patterson, and J.S. Macdonald

Fisheries and Oceans Canada
Science Branch, Pacific Region
Cooperative Resource Management Institute
School of Resource and Environmental Management
Simon Fraser University
Burnaby, B.C. V5A 1S6

2008

**Canadian Technical Report of
Fisheries and Aquatic Sciences 2797**



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canada

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457-714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715-924 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques de Pêches et Océans Canada, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications à part entière. Le titre exact figure au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques*.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 456 de cette série ont été publiés à titre de Rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de Rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de Rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Canadian Technical Report of
Fisheries and Aquatic Sciences 2797

2008

EXPLORATORY CORRELATION ANALYSIS OF MULTI-SITE SUMMER
TEMPERATURE AND FLOW DATA IN THE FRASER RIVER BASIN

by

M.J. Hague, D.A. Patterson, and J.S. Macdonald

Fisheries and Oceans Canada
Science Branch, Pacific Region
CRMI c/o School of Resource and Environmental Management
Simon Fraser University
Burnaby, BC
V5A 1S6

© Her Majesty the Queen in Right of Canada, 2008.
Cat. No. Fs 97-6 2797E ISSN 0706-6457

Correct citation for this publication:

Hague, M.J., Patterson, D.A., and Macdonald, J.S. 2008. Exploratory correlation analysis of multi-site summer temperature and flow data in the Fraser River Basin. Can. Tech. Rep. Fish. Aquat. Sci. 2797 viii + 60 p.

TABLE OF CONTENTS

List of Tables	iii
List of Figures	v
Abstract	vii
Introduction	1
Methods	3
Data sources - temperature	3
Data sources - flow	3
Migration routes	4
Migration rates	5
Average environmental conditions	8
Data analysis	10
Correlations	10
Linear regression	10
Sensitivity analyses	11
Results	11
Early Stuart	13
Early Summer	13
Summer	14
Sensitivity analyses	15
Migration rates	15
Seasonality	19
Discussion	22
Is the lower Fraser an appropriate surrogate?	22
Spatio-Temporal synchrony in river environment	22
Seasonality in environmental correlations	23
Recommendations	24
Acknowledgements	24
Executive summary	25
Literature cited	26
Appendix A – Multi-site temperature data	31

LIST OF TABLES

- Table 1. Summary of recent archived temperature data at 10 main locations within the Fraser River basin. Recent data (1990 onwards) was compiled from information available through the DFO Environmental Watch Program. Site codes combine the name of the watershed area with the kilometres the site is located from the downstream river confluence (e.g. FR190 – 190km upstream of the Fraser River delta). 3
- Table 2. Summary of available archived flow data at 9 WSC sites selected to pair with available temperature logger stations provided in Table 1. Data was obtained from Environment Canada through the WSC website (<http://scitech.pyr.ec.gc.ca/waterweb/formNav.asp>). 4

Table 3. Environmental condition recording sites (using temperature site code) associated with Early Stuart, Early Summer (divided into lower/mid-river spawners and upper river spawners), and Summer run migration routes. En route logger stations are identified with an X.	5
Table 4. A summary of available mean migration rate estimates for upriver migrating Fraser sockeye salmon by year and reach for the Early Stuart run-timing group, with associated references.	6
Table 5. A summary of available mean migration rate estimates for upriver migrating Fraser sockeye salmon by year and reach for the Early Summer run-timing group, with associated references.	7
Table 6. A summary of available median migration rate estimates for upriver migrating Fraser sockeye salmon by year and reach for the Summer run-timing group, with associated references. Unless otherwise indicated, median estimates were derived from radio tagging data.	8
Table 7. Mean, minimum and maximum recorded migration rates for spawning Fraser River sockeye salmon, distance between FR190 and subsequent temperature logger locations, and expected number of days travel between Hells Gate and subsequent locations for fish of different run-timing groups. Fractions are rounded up until the next day.	10
Table 8. Correlation matrix results for a comparison of average 31-day average temperature (Temp) and flow across all temperature logger sites along the migration route of Early Stuart Fraser sockeye. See Tables 1 and 2 for site names corresponding to each code.	13
Table 9. Correlation matrix results for a comparison of 31-day temperature (Temp) and flow across all temperature logger sites along the migration route of Early Summer Fraser sockeye. See Tables 1 and 2 for site names corresponding to each code.	13
Table 10. Correlation matrix results for a comparison of 31-day average temperature (Temp) and flow across all temperature logger sites along the migration route of Summer Fraser sockeye. See Tables 1 and 2 for site names corresponding to each code.	15

LIST OF FIGURES

- Figure 1. Map of Fraser River watershed. DFO Environmental Watch Program (EWatch) real-time temperature logger stations are indicated with a star, as well as river abbreviation and distance from each downstream river mouth (e.g. CR50 = Chilcotin River, 50km upstream from the Fraser River-Chilcotin River confluence). Water Survey of Canada (WSC) real-time flow logger stations are indicated with an open circle. Early Stuart, Early Summer and Summer sockeye salmon spawning grounds are indicated with diamonds, circles, and squares respectively. 2
- Figure 2. A comparison of average 31-day daily mean temperature (left plots) and flow (right plots) across all environmental data recording stations along the migration route of Early Stuart (top), Early Summer (middle) and Summer (bottom) Fraser sockeye run timing groups from 1995-2007. Calculated using the historic 50% Hells Gate date and lag times using mean reported migration rates (Table 7). Site codes are defined in Tables 1 and 2. Error bars are omitted for clarity. Black (left-side) flow axes are for site FR190; grey (right-side) flow axes pertain to all other sites. 12
- Figure 3. Changes in the correlation of river temperatures between the Fraser River at Qualark (FR190) and nine upriver sites (see Table 2 for full site names) as a function of migration rate. Assuming a July 14th Hells Gate 50% date. Correlations between 31-day average temperatures for each pair of sites were calculated for migration rate using years of data from 1995 – 2007. The figures show the mean Pearson's *r* correlation coefficient (solid line) and associated 95% confidence intervals (dashed lines). 16
- Figure 4. Changes in the correlation of river flows between the Fraser River at Qualark (FR190) and nine upriver sites (see Table 2 for full site names) as a function of migration rate. Assuming a July 14th Hells Gate 50% date. Correlations between 31-day average flows for each pair of sites were calculated for migration rate using years of data from 1995 – 2007. The figures show the mean Pearson's *r* correlation coefficient (solid line) and associated 95% confidence intervals (dashed lines). 17
- Figure 5. Correlations (Pearson's *r*) between 31-day average temperatures in the lower Fraser and temperatures at upriver EWatch sites as a function of distance from the Fraser at Qualark temperature station (km) and migration rate (km/day). Assuming a July 14th Hells Gate 50% date. 18
- Figure 6. Correlations (Pearson's *r*) between 31-day average flows in the lower Fraser and temperatures at upriver EWatch sites as a function of distance from the Fraser at Qualark temperature station (km) and migration rate (km/day). Assuming a July 14th Hells Gate 50% date. 19

- Figure 7. Seasonal changes in the correlation of river temperatures between the Fraser River at Qualark (FR190) and nine sites located upriver (see Table 2 for full site names). Correlations between 31-day average temperatures for each pair of sites were calculated for each Hells Gate 50% date using years of data from 1995 – 2007. The figures show the mean Pearson's r correlation coefficient (solid line) and associated 95% confidence intervals (dashed lines). Assuming a 42km/day migration rate..... 20
- Figure 8. Seasonal changes in the correlation of river flows between the Fraser River at Qualark (FR190) and nine sites located upriver (see Table 2 for full site names). Correlations between 31-day average flows for each pair of sites were calculated for each Hells Gate 50% date using years of data from 1995 – 2007. The figures show the mean Pearson's r correlation coefficient (solid line) and associated 95% confidence intervals (dashed lines). Assuming a 42km/day migration rate..... 21

ABSTRACT

Hague, M.J., Patterson, D.A., and Macdonald, J.S. 2008. Exploratory correlation analysis of multi-site summer temperature and flow data in the Fraser River Basin. Can. Tech. Rep. Fish. Aquat. Sci. 2797 viii + 60 p.

Fisheries researchers currently use lower Fraser River summer temperature and flow conditions as indices of the total environmental exposure experienced by migrating adult sockeye salmon (*Oncorhynchus nerka*). If lower Fraser temperature (measured 165km upstream of the river mouth at Qualark) and flow (measured 150 km upstream at Hope) values are not well correlated to values elsewhere in the Fraser Basin (ranging from 330km to 970km upstream), the current indices may not reflect the true exposures experienced by the migrants. The purpose of this report was to compile available multi-site temperature and flow information for the Fraser River and to determine whether data from lower river stations are appropriate environmental indices for the basin as a whole. In general, lower Fraser environmental conditions were well correlated ($r > 0.6$) to conditions upriver; however, correlation strength decreased as a function of increasing distance and/or slower migration rates (i.e. increased lag time between measurements) and the magnitude of encountered temperatures and flows was highly variable. Earlier in the summer, river temperatures and flows appear to be more strongly influenced by large spatial scale processes such as regional air temperatures and spring snowmelt runoff. Synoptic weather changes, flow management regimes, and influences from lake-headed systems may all contribute to localized differences in river environment, particularly towards late summer. Our results show that adult salmon encounter a range of temperature and flow conditions along their freshwater migration route and that these values may not be consistently well-correlated to lower river conditions, particularly for populations with natal spawning grounds > 500km from the ocean or for populations entering the river after mid-August. These results provide rationale for further exploration into the use of multi-site, alternate-site or cumulative exposure models to better reflect the impact of freshwater migration conditions on the health and spawning success of Fraser River sockeye salmon populations.

RÉSUMÉ

Hague, M.J., Patterson, D.A., and Macdonald, J.S. 2008. Exploratory correlation analysis of multi-site summer temperature and flow data in the Fraser River Basin. Can. Tech. Rep. Fish. Aquat. Sci. 2797 viii + 60 p.

Les chercheurs dans le domaine halieutique utilisent actuellement les données sur les conditions estivales de température et de débit du bas Fraser comme indices de l'exposition environnementale totale des saumons rouges (*Oncorhynchus nerka*) adultes en migration. Si les valeurs de température du bas Fraser (mesurées à 165 km en amont de l'embouchure du fleuve, à Qualark) et de débit (mesurées à 150 km en amont de la communauté de Hope) ne sont pas bien corrélées aux valeurs provenant d'autres emplacements dans le bassin du Fraser (de 330 à 970 km en amont), les indices actuels ne pourront pas refléter l'expérience réelle des individus migrants en matière d'exposition. L'objectif du présent rapport était de compiler les renseignements sur la température et le débit du Fraser provenant de nombreux sites accessibles et de déterminer si les données des stations du cours inférieur du fleuve s'avèrent de bons indices environnementaux pour l'ensemble du bassin. De façon générale, les conditions environnementales du bas Fraser sont très bien corrélées ($r > 0,6$) aux conditions trouvées en amont; cependant, le taux de corrélation baissait à mesure que la distance augmentait et/ou que le taux de migration diminuait (délai plus grand entre les prises de mesures), et l'ampleur des températures et des débits observés était très variable. Au début de l'été, les températures et les débits semblaient être influencés plus fortement par les processus à grande échelle spatiale comme les températures de l'air de la région et le ruissellement nival printanier. Les variations météorologiques synoptiques, les régimes de gestion des débits et l'influence des réseaux alimentés par un lac pourraient tous contribuer aux différences localisées de l'environnement fluvial, surtout vers la fin de l'été. Nos résultats indiquent que les saumons adultes rencontrent une vaste gamme de conditions de températures et de débit tout au long de leur parcours de migration en eau douce et que ces valeurs ne sont peut-être pas systématiquement bien corrélées aux conditions du bas Fraser, particulièrement pour les populations dont les frayères natales se trouvent à plus de 500 km de l'océan ou pour celles qui atteignent le fleuve après la mi-août. Vu ces résultats, il est justifié d'étudier de manière plus approfondie l'usage de modèles à exposition axés sur des sites multiples, à exposition axés sur des sites alternatifs ou à exposition cumulative dans le but de mieux refléter l'incidence des conditions migratoires en eau douce sur le taux de fraye et la santé des populations de saumons rouges du Fraser.

INTRODUCTION

Each year a variable number of Fraser River sockeye salmon perish en route. A surrogate for this loss is based on the discrepancy between lower river escapement estimates made at a hydroacoustic facility near Mission, BC (Woodey 1987) and spawning ground escapement estimates, after adjusting for in-river catches. These discrepancies are correlated to Fraser River temperature values measured at Qualark Creek, BC (165 km upstream of Fraser River mouth) and to flow recorded near Hope, BC (150km upstream) (both located near the FR190 site on Figure 1). The management approach for Fraser River sockeye salmon utilises the relationship between historic discrepancy estimates and environmental conditions to predict the difference between lower-river and upriver escapement estimates. Managers use these "Management Adjustment" (MA) models (Hague and Patterson 2007) to adjust catches in accordance to forecasts of run-specific in-river discrepancies and increase the probability of achieving specified spawning escapement targets. Currently, MA models only use the environmental data collected from these two lower river sites. The assumption being that the lower river is a reasonable surrogate for environmental exposures experienced by all runs of returning adult salmon throughout their migration. If lower Fraser River water temperature and flow are not closely correlated to conditions elsewhere in the basin, a multi-site or cumulative exposure discrepancy model may better reflect the true environmental exposures experienced by adult salmon migrants and ultimately reduce the variance in discrepancy forecasts.

Using Fraser River sockeye salmon as a case-study, the purpose of this report was to explore the relationship between temperature and flow conditions at multiple locations throughout the Fraser River Basin. We examined average en route temperatures and flow experienced by three of the four sockeye salmon run-timing groups (Early Stuart, Early Summer and Summer) as they migrate to their respective spawning grounds (Figure 1). The goal was to determine whether lower-river environmental conditions are an appropriate proxy for describing average water temperature and flow exposures along entire migration routes. Two main objectives were evaluated to address this goal: 1) determine whether time series of average summer water temperature and flow conditions from multiple sites over the previous 13 years are highly correlated, 2) determine if fish are exposed to significantly different magnitudes of temperature and flow at different locations along their migration route. Sensitivity analyses were employed to test the robustness of results to various factors including: seasonality and lag-time among locations (i.e. the time required for salmon to migrate from one site to another). Our null hypotheses were: a) average temperature and flow exposures experienced by adult migrants in the lower Fraser will be strongly correlated to environmental exposures measured at sites in close proximity, and b) this correlation will decrease as distance and/or migration time from the lower Fraser locations increases. These findings will determine the worth of further investigations into the use of alternative, multi-site or cumulative exposure models for describing the relationship between in-river salmon escapement discrepancies and river environmental conditions.

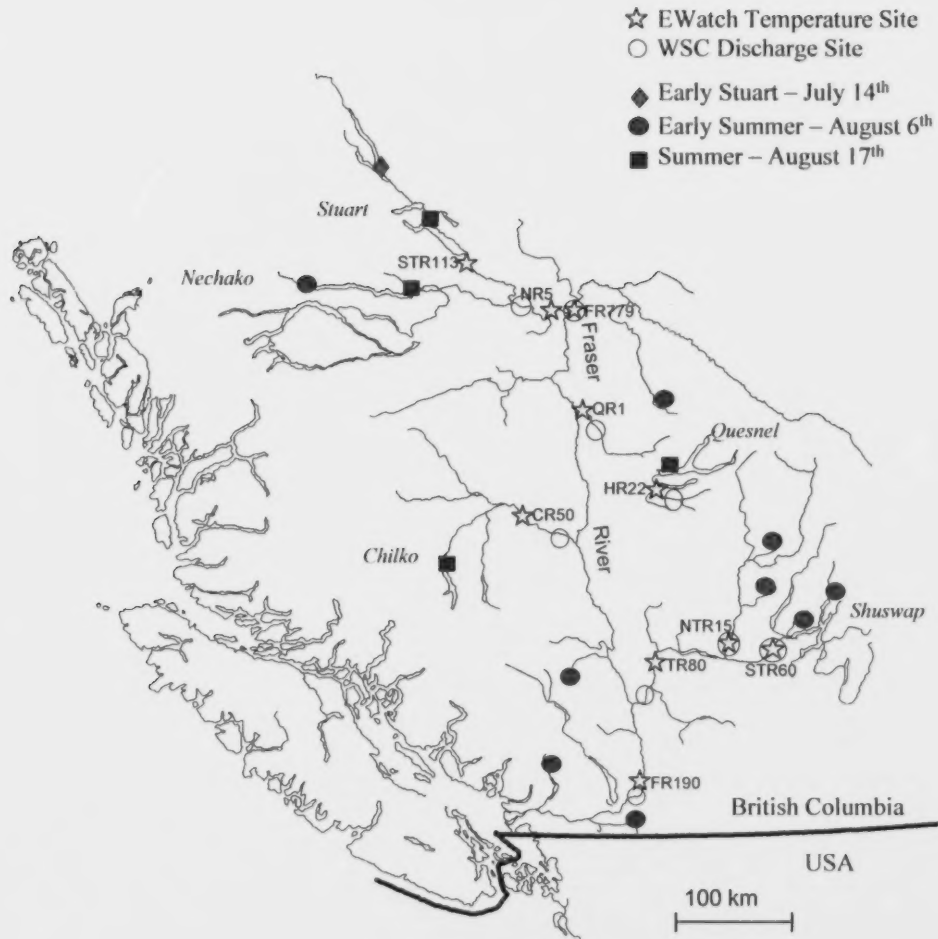


Figure 1. Map of Fraser River watershed. DFO Environmental Watch Program (EWatch) real-time temperature logger stations are indicated with a star, as well as river abbreviation and distance from each downstream river mouth (e.g. CR50 = Chilcotin River, 50km upstream from the Fraser River-Chilcotin River confluence). Water Survey of Canada (WSC) real-time flow logger stations are indicated with an open circle. Early Stuart, Early Summer and Summer sockeye salmon spawning grounds are indicated with diamonds, circles, and squares respectively.

METHODS

DATA SOURCES - TEMPERATURE

Fisheries and Oceans Canada (DFO) monitors river temperature conditions through its Fraser River Environmental Watch Program (EWatch) (D. Patterson, DFO, pers. comm. 2006; http://www-sci.pac.dfo-mpo.gc.ca/fwh/index_e.htm). There are 10 real-time temperature logger sites with near-consistent recordings of summer river temperature data (daily mean and max) dating back to the mid 1990's (Table 1; Figure 1; see Appendix A for daily means). Collection methods and site descriptions for each location can be found in Lauzier et al (1995), Barnes and Walthers (1997), Brown et al. (1998), and Barnes and Magnusson (2000). In addition, there is a longer time series of data for the Fraser River at Qualark dating back to the early 1940's (Patterson et al. 2007a). Analyses were performed using a subset of the 10 main loggers for years between 1995 and 2007, and dates between June 1 and September 30. This date range was selected because it was the most consistently available and because it represents the main period of sockeye salmon migration within the Fraser River.

Table 1. Summary of recent archived temperature data at 10 main locations within the Fraser River basin. Recent data (1990 onwards) was compiled from information available through the DFO Environmental Watch Program. Site codes combine the name of the watershed area with the kilometres the site is located from the downstream river confluence (e.g. FR190 – 190km upstream of the Fraser River delta).

Site location	Site code	Years available
Fraser River at Qualark	FR190	1941-2007
Thompson River at Ashcroft	TR80	1995 - 2007
North Thompson River at Rayleigh	NTR15	1996 – 2007 (missing 2004)
South Thompson River at Chase	STR60	1994 - 2007
Chilcotin River at Alexis Creek	CR50	1996 - 2007
Quesnel River at Quesnel	QR1	1993 – 2007 (missing 1997)
Horsefly River at Horsefly	HOR22	1995 – 2007 (missing 1997)
Nechako River at Prince George	NR5	1993-2007
Stuart River at Fort St. James	SR113	1995 – 2007
Fraser River at Shelley	FR779	1994 - 2007

DATA SOURCES - FLOW

Maintaining real-time and archived flow conditions at several sites throughout the Fraser basin falls under the mandate of Environment Canada. Archived data is available from the Water Survey of Canada (WSC) website (<http://www.wsc.ec.gc.ca/>). For most sites, flow time-series extend back to the mid 1900's, and in some cases data is available back to the early 1900's. Data is generally recorded as daily means and records exist for the entire year (January 1 – December 31). Nine flow sites were selected based on

their close proximity to the EWatch temperature sites (Table 2; Figure 1). No WSC flow loggers are present on the Stuart River; however, Stuart flows were approximated by taking the difference in Nechako River flows above and below the Stuart-Nechako confluence. Flow data was only analysed for years and dates for which temperature information was also accessible (1995-2007; June 1 – Sep 30). For simplicity, flow data was identified using the site code associated with the paired temperature logger station (Table 2).

Table 2. Summary of available archived flow data at 9 WSC sites selected to pair with available temperature logger stations provided in Table 1. Data was obtained from Environment Canada through the WSC website (<http://scitech.pyr.ec.gc.ca/waterweb/formNav.asp>).

Flow site location	Site code	Years available
Fraser River at Hope	FR190	1912 – 2007
Thompson River near Spences Bridge	TR80	1951 – 2007
North Thompson River at McLure	NTR15	1958 – 2007
South Thompson River at Chase	STR60	1911 – 2007 (missing 1959 – 1970)
Chilcotin River below Big Creek	CR50	1970 – 2007
Quesnel River at Quesnel	QR1	1939 – 2007
Horsefly River at McKinley	HOR22	1954 – 2007 (missing 1959 – 1963)
Nechako River at Isle Pierre	NR5	1950 – 2007
Stuart River ¹	SR113	NA
Fraser River at Shelley	FR779	1950 – 2007

¹There is no flow monitoring for the Stuart River. Stuart River flows were approximated using the difference between flows for the Nechako River downstream (Nechako at Isle Pierre) and upstream (Nechako at Vanderhoof) of the Stuart-Nechako confluence.

MIGRATION ROUTES

For management purposes, Fraser sockeye are divided into four major groupings related to river arrival timing (Early Stuart, Early Summer, Summer, and Late-run; Gable and Cox-Rogers 1993). Migration routes vary greatly for fish both among and within each run group. The migration routes associated with the Early Stuart, Early Summer and Summer runs were cross-referenced with temperature and flow recorder locations (Table 3; Figure 1) to facilitate the discussion of multi-site environmental relationships specific to each management group. The migration route of the Early Stuart run-timing group extends along the Fraser River mainstem, into the Nechako River, and then branches into the Stuart River until Takla Lake. Both Early Summer and Summer-run sockeye experience diverse migration routes. There are two main divisions of Early Summer salmon: fish that migrate to areas in the lower and mid- Fraser basin (i.e. Chilliwack Lake, Gates Creek, Thompson system), and those that migrate further north (i.e. Nechako and Bowron Rivers). Summer run fish undergo migrations to spawning

grounds in the Chilcotin, Quesnel/Horsefly and Stuart/Nechako regions (see Figure 1 for spawning ground locations).

Table 3. Environmental condition recording sites (using temperature site code) associated with Early Stuart, Early Summer (divided into lower/mid-river spawners and upper river spawners), and Summer run migration routes. En route logger stations are identified with an X.

Run-timing group	Early Stuart	Early Summer Lower/Mid	Early Summer Upper	Summer
Site				
FR190	X	X	X	X
TR80		X		
NTR15		X		
STR60		X		
CR50				X
QR1				X
HOR22				X
NR5	X		X	X
SR113	X			X
FR779			X	

MIGRATION RATES

Comparison of environmental conditions experienced by adult sockeye during their upriver migration requires consideration of the migration speeds among sampling locations. Information from three separate primary studies was reviewed. The earliest reported migration rates were estimated from traditional tagging studies conducted during the 1940's as well as correlations between fishing closures and pulses of escapement used to estimate migration rates of several sockeye stocks in the 1940's and 1950's (Killick 1955). Killick (1955) noted differences in migration rates for stocks with later river-entry times. However, results derived from these early tagging experiments should be interpreted with caution as they may be biased due to handling effects and biases resulting from delayed tag collection (Killick 1955). Information on Early-Stuart migration rates was also collected during radio tagging studies performed during the mid-1990s (Hinch and Rand 1998; Rand and Hinch 1998; Hinch and Rand 2000). These studies found that Early Stuart migration rates varied in different reaches of the river, in particular dropping sharply as fish pass through Hells Gate (Hinch and Rand 1998).

The most recent investigation into adult sockeye freshwater migration rates consists of a multi-year radio-tagging study performed by DFO and LGL Ltd. Environmental Research Associates (English et al. 2003; English et al. 2004; English et al. 2005; Robichaud and English 2006). These studies determined that migration rates for different spawning populations vary depending on the distance to the spawning ground and/or on river entry date (Robichaud and English 2006). The radio-tagging data also

revealed significant differences between the migration rates of Summer- and Late-run fish, and among individual Summer-run stocks.

Table 4. A summary of available mean migration rate estimates for upriver migrating Fraser sockeye salmon by year and reach for the Early Stuart run-timing group, with associated references.

Migration rate (km/d)						
Year	1945	1952	1993-95	1998	2006	Reference
Site						
Hells Gate-Stuart Outlet	44.3†	48.1†				Killick 1955
Hells Gate-Forfar Creek	39.7•					Killick 1955
Below Hope			31.2‡			Hinch and Rand 1998
Mission-Hells Gate					10*	Rand and Hinch 1998
Hells Gate-Prince George					54.4*	Rand and Hinch 1998
Prince George-Stuart Lake				39.7		Rand and Hinch 1998
Stuart Lake-spawning grounds				59.6		Rand and Hinch 1998

† Tagging data

‡ Radio tagging data

• Fishing closure/escapement pulse correlation

* Calculated from a negative linear regression (Hinch and Rand 1998) between flow and migration rate using the historic mean flow associated with the 2006 pre-season forecasted July 21 median peak date at Hells Gate

Table 5. A summary of available mean migration rate estimates for upriver migrating Fraser sockeye salmon by year and reach for the Early Summer run-timing group, with associated references.

Migration rate (km/d)						
Year Site	1947	1948	1951	1952	2005*	Reference
New West-Hells Gate			50.0•	46.8•		Killick 1955
Hells Gate-Bowron	42.6†	38.4†	53.2•	50.0•		Killick 1955
New West-Bowron			35.5•	33.9•		Killick 1955
Mission to Quesnel					38	Robichaud and English 2006
Mission to Chilcotin					33	Robichaud and English 2006
Mission to Thompson					29	Robichaud and English 2006
Mission to Hells Gate					28	Robichaud and English 2006
Mission to Hope					32	Robichaud and English 2006

† Tagging data

• Fishing closure/escapement pulse correlation

* Approximated from Figure 8 in Robichaud and English 2006.

Table 6. A summary of available median migration rate estimates for upriver migrating Fraser sockeye salmon by year and reach for the Summer run-timing group, with associated references. Unless otherwise indicated, median estimates were derived from radio tagging data.

Migration rate (km/d)					
Year Site	1953	2002*	2003*	2005	Reference
Hells Gate- Quesnel	51.6•				Killick 1955
Hells Gate-Chilko	34.7•				Killick 1955
Hells Gate-Stellako	36.3•				Killick 1955
Mission-Hells Gate		37.2	36.5		English et al. 2003; English et al. 2004
Mission-Thompson		37	35.5	31.5	English et al. 2003; English et al. 2004; Robichaud and English 2006
Mission-Chilcotin		40	38.75		English et al. 2003; English et al. 2004
Mission-Quesnel		42.75	40.75	38.8	English et al. 2003; English et al. 2004; Robichaud and English 2006
Thompson- Chilcotin		43	41	38.9	English et al. 2003; English et al. 2004; Robichaud and English 2006
Thompson- Quesnel		47.2	45.25		English et al. 2003; English et al. 2004
Chilcotin-Quesnel				51.5	Robichaud and English 2006

• Fishing closure/escapement pulse correlation (means)

* Median values averaged over estimates for four Summer-run stocks

Although several authors (see above) have recognized that migration rates vary as a function of population and river section (among numerous other factors), for simplification purposes we assumed a constant migration rate for each sockeye run group using the average of the literature-reported values (Table 7).

AVERAGE ENVIRONMENTAL CONDITIONS

The length of a sockeye run (i.e. the number of days over which a sockeye run continuously enters the river) varies both among run groups and across years (Hague and Patterson 2007). On average, a 31-day symmetric period centered on the date associated with the median of each run (i.e. hereafter referred to as the 50% date) captures a period of time that includes approximately 90% of fish (Hague and Patterson

2007). Therefore, a symmetric 31-day timeframe centered on the 50% date for each location was used to capture the average environmental conditions experienced by a given run at a single site.

Annual river entry timing is also known to be variable (Hague and Patterson 2007), and is influenced by sea surface temperature (Blackbourn 1987; Hodgson et al. 2006), Alaskan sea currents (Thomson et al. 1994), and northern diversion rates (proportion of fish returning via Johnstone Strait vs. the Strait of Juan de Fuca; McKinnell et al. 1999). However, for simplicity, and to reduce a known component of interannual variability, the historic median 50% date for each run to pass Hells Gate (Early Stuart = July 14; Early Summer = August 10; Summer = August 18) was used to calculate lower river temperature and flow conditions recorded at Qualark and Hope, respectively. The estimated number of days travel time between the first lower-river location (FR190) and subsequent sites was calculated using the average migration rate (km/d) estimated for each run-timing group and the distance between EWatch temperature logger sites (Table 7). The number of migration days for a particular run to reach each site was added to the historic 50% migration date at Hells Gate to calculate the mid-point of environmental exposures for subsequent sites.

Table 7. Mean, minimum and maximum recorded migration rates for spawning Fraser River sockeye salmon, distance between FR190 and subsequent temperature logger locations, and expected number of days travel between Hells Gate and subsequent locations for fish of different run-timing groups. Fractions are rounded up until the next day.

		Days Travel								
		Early Stuart			Early Summer			Summer		
	Migration Rate (km/d)	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
		45.3	31.2	59.6	42.0	28.0	53.2	40.3	31.5	51.6
Site	Distance (km)									
TR80	129.3				4	5	3			
NTR15	226.3				6	8	5			
STR60	266.9				7	10	6			
CR50	346.4							9	11	7
QR1	419.6							11	14	9
HOR22	548.8							14	18	11
NR5	568.8	14	19	10	14	20	11	15	19	12
SR113	767.8	19	25	13				20	25	15
FR779	591.3				15	21	12			

DATA ANALYSIS

Correlations

In the context of assessing the appropriateness of lower river environmental conditions as predictors of escapement discrepancies, we were specifically interested in whether the average environmental conditions (using the average of daily means over a 31-day symmetric period, as described above) experienced by each sockeye run group in the lower Fraser River were significantly correlated to conditions the salmon experienced during upriver sections of their spawning migration. To answer this question, we calculated Pearson's product-moment correlation coefficients for time series (1995 – 2007) of 31-day symmetric average temperature or flow data for every site location along the migration route of a particular run group (Table 3). Strong correlation between lower and upper Fraser temperature and flow conditions would suggest that temperatures and flows in the lower Fraser are a reasonable surrogate for describing basin-wide environmental exposures.

Linear regression

Some studies suggest salmon may become more susceptible to temperature or flow conditions above population-specific thresholds (Lee et al. 2003; Farrell et al. 2008). Lower Fraser flow levels are the highest in the system and due to basin dynamics are often accompanied with the greatest water velocities; however, fish have the potential to

experience more extreme temperatures upstream of Qualark. Regardless of the degree to which sites are correlated, the site with the most extreme conditions may provide the most physiologically appropriate predictions of migration success. Therefore, we also explored whether there were significant differences in temperature and flow values among sites and/or years.

A step-wise Akaike's Information Criterion (AIC) procedure was used to select the best-fit model derived from the initial formula: *environmental data* ~ *sites* + *years* (where data equals the average temperature/flow measured over the 31-day period centred on the median historic date each run group passes each site). Once the most appropriate model was selected, a one- or two-way analysis of variance (ANOVA) was used to evaluate differences in temperature or flow among sites and/or years.

Sensitivity analyses

Sensitivity analyses were conducted to explore the robustness of the correlation results to changes in: (a) the lag time between site measurements (represented by variable migration rates), (b) between-site distances, and (c) the Hells Gate 50% date (seasonality). Correlation analyses between lower river (Qualark/Hope) and upriver sites were repeated using a range of migration rates, and along a continuum of Hells Gate 50% dates ranging from July 1 – August 30. Our *a priori* hypothesis was that correlations between lower and upper Fraser Basin water temperatures and flows would increase as a function of decreased distance and increased migration rates (i.e. decreased lag times). In other words, we anticipated some level of spatial and temporal synchrony in the environmental conditions among our sites.

All analyses were completed using the statistical software package R (<http://cran.r-project.org/>).

RESULTS

Early Stuart, Early Summer and Summer-run sockeye experience a wide range of temperatures and flows both inter-annually and spatially during their return migration through the Fraser watershed (Figure 2). The differences in Figure 2 reflect the various run group-specific migration routes (Table 3, Figure 1), river-entry times and average migration rates (Table 7).

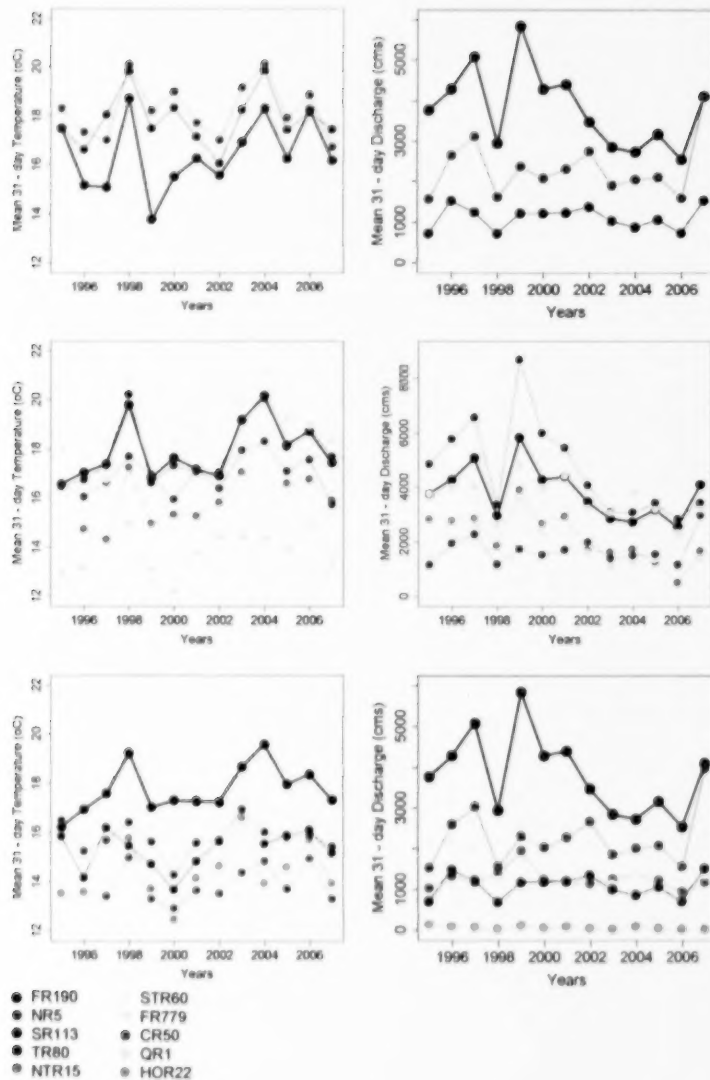


Figure 2. A comparison of average 31-day daily mean temperature (left plots) and flow (right plots) across all environmental data recording stations along the migration route of Early Stuart (top), Early Summer (middle) and Summer (bottom) Fraser sockeye run timing groups from 1995-2007. Calculated using the historic 50% Hells Gate date and lag times using mean reported migration rates (Table 7). Site codes are defined in Tables 1 and 2. Error bars are omitted for clarity. Black (left-side) flow axes are for site FR190; grey (right-side) flow axes pertain to all other sites.

Results of a step-wise AIC procedure selected the models: *Temperature ~ Site* ($F = 90.6$; $p < 0.001$) + *Year* ($F = 11.7$; $p < 0.001$), and *Flow ~ Site* ($F = 180.9$; $p < 0.001$) + *Year* ($F = 4.6$; $p < 0.001$), as the best fits to the multi-site Early Summer temperature and flow data. Temperatures in 1998, 2004 and 2006 were warmer, on average, than those experienced in most other years. While temperatures in the lower Fraser and Thompson mainstem were almost identical, Early Summer fish tended to experience the warmest temperatures along their migration route in the South Thompson. The *Year* effect in the flow model appeared to be primarily driven by significantly higher flows in 1999 compared to most other years.

SUMMER

Lower Fraser temperatures experienced by Summer-run sockeye were well correlated to temperatures in the Chilcotin and Quesnel systems, but more weakly correlated to temperatures in the Horsefly, Nechako and Stuart (Table 10). Hope flows were well correlated to Quesnel values, but only weakly correlated to flow values elsewhere along the Summer migration route (Table 10). In general, the temperature and flow correlations for the Summer-run were weaker than those observed for the Early Stuart and Early Summer runs (compare Tables 8, 9, 10). For example, the temperature correlation between the Fraser at Qualark and Stuart at Fort St. James sites for Early Stuart fish was $r = 0.64$ (Table 8), but the correlation coefficient for these two sites for Summer fish was only $r = 0.55$ (Table 10).

Table 10. Correlation matrix results for a comparison of 31-day average temperature (Temp) and flow across all temperature logger sites along the migration route of Summer Fraser sockeye. See Tables 1 and 2 for site names corresponding to each code.

	CR50		QR1		HOR22		NR5		SR113	
	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow	Temp	Flow
FR190	0.88	0.52	0.78	0.83	0.52	0.53	0.65	0.47	0.55	0.56
CR50			0.80	0.36	0.76	0.29	0.79	0.04	0.66	0.14
QR1					0.53	0.78	0.70	0.09	0.38	0.33
HOR22							0.85	-0.12	0.83	-0.04
NR5									0.82	0.85

The step-wise AIC procedure identified the model *Temperature ~ Site* ($F = 78.2$; $p < 0.001$) + *Year* ($F = 9.6$; $p < 0.001$) for 31-day average temperatures experienced by Summer-run sockeye, and the model *Flow ~ Site* ($F = 181.0$; $p < 0.001$) + *Year* ($F = 4.6$; $p < 0.001$) for average flows.

SENSITIVITY ANALYSES

Migration rates

In general, faster migration rates (i.e. decreased lag time in the measurement of environmental variables between sites), resulted in stronger correlations between average temperature (or flow) exposures experience at the Fraser River at Qualark (or Hope) and exposures experienced at upriver stations (Figures 3 and 4). However, the specific response to changes in migration rate was variable depending on site. Preliminary analyses (not shown) also showed a change in these relationships depending on the initial Hells Gate 50% date (the Early Stuart July 14th historic Hells Gate date was used to produce Figures 3 and 4).

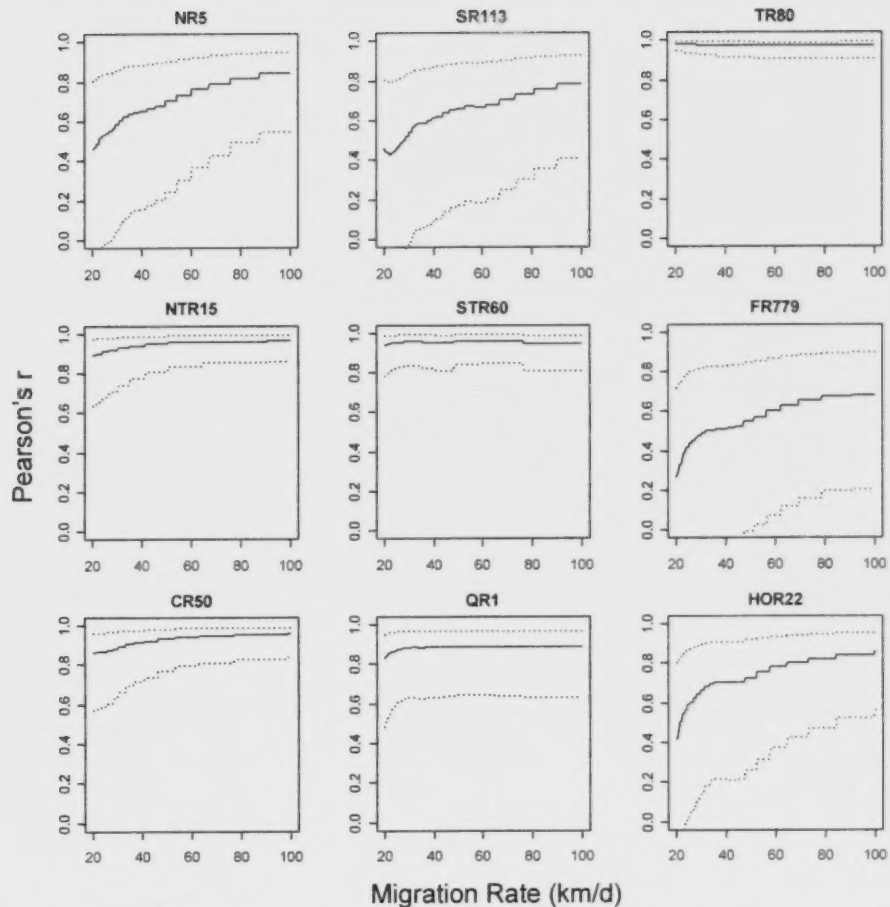


Figure 3. Changes in the correlation of river temperatures between the Fraser River at Qualark (FR190) and nine upriver sites (see Table 2 for full site names) as a function of migration rate. Assuming a July 14th Hells Gate 50% date. Correlations between 31-day average temperatures for each pair of sites were calculated for migration rate using years of data from 1995 – 2007. The figures show the mean Pearson's r correlation coefficient (solid line) and associated 95% confidence intervals (dashed lines).

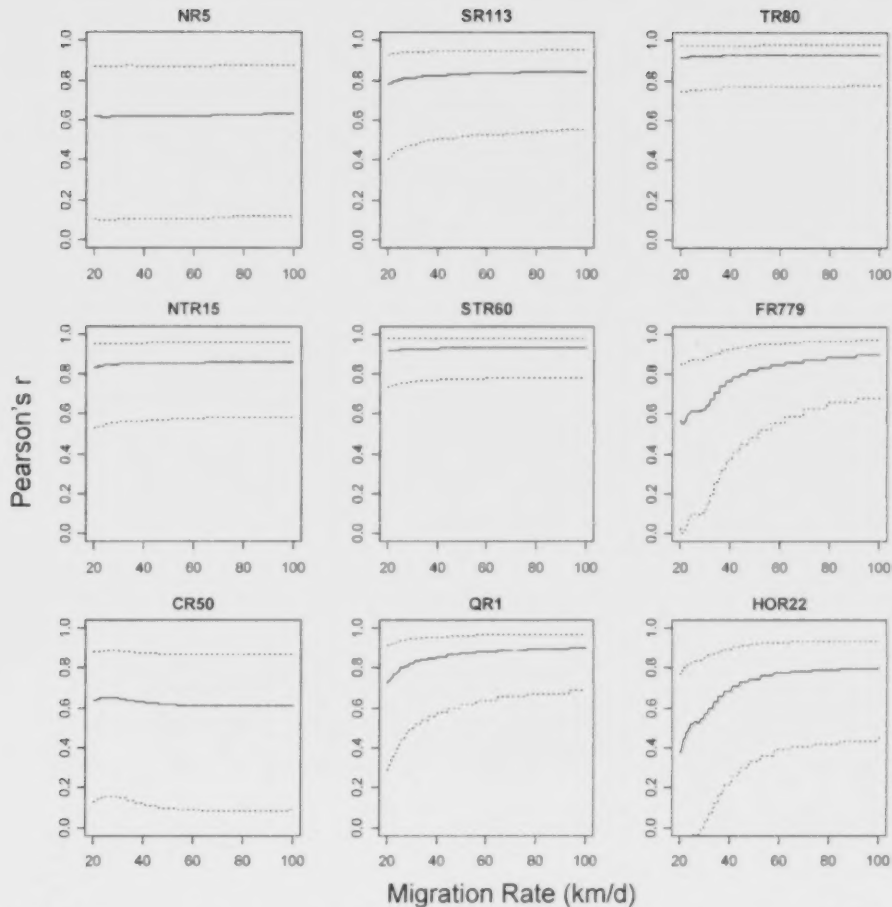


Figure 4. Changes in the correlation of river flows between the Fraser River at Qualark (FR190) and nine upriver sites (see Table 2 for full site names) as a function of migration rate. Assuming a July 14th Hells Gate 50% date. Correlations between 31-day average flows for each pair of sites were calculated for migration rate using years of data from 1995 – 2007. The figures show the mean Pearson's *r* correlation coefficient (solid line) and associated 95% confidence intervals (dashed lines).

To provide a better illustration of possible interactions between spatial and temporal effects, the correlation between lower and upper river environmental conditions was plotted as a function of both distance and migration rate (Figures 5 and 6). There were strong patterns of spatio-temporal correlations in the temperature exposures (Figure 5). Temperatures were most highly correlated for sites in closest proximity to the lower Fraser and/or when the lag time between sites was short (i.e. fast migration rate). The influence of migration rate on correlation strength was greatest for sites > 500km from

FR190. Vice versa, the influence of distance on correlation strength was greatest when migration rates were slow. In other words, all lower river temperatures were highly correlated regardless of assumed migration rate, likely because the short distance between them translated into only a moderate delay in the temperatures experienced by the migrating salmon. Alternatively, if fish were swimming at top ground speeds (50-60km/day) throughout their migration, the temperatures they experienced in the Stuart River were well-correlated to those they experienced at Qualark (because delay-time was decreased due to faster swim speeds).

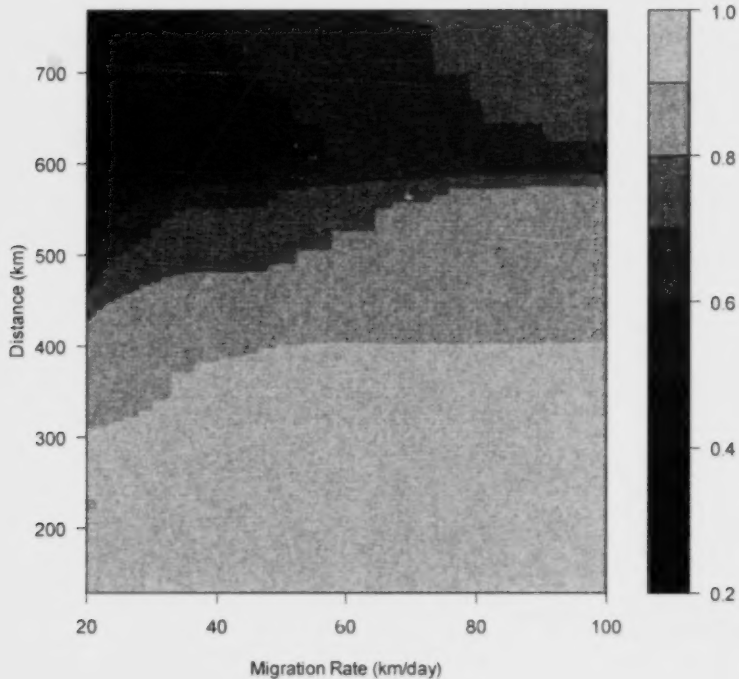


Figure 5. Correlations (Pearson's r) between 31-day average temperatures in the lower Fraser and temperatures at upriver EWatch sites as a function of distance from the Fraser at Qualark temperature station (km) and migration rate (km/day). Assuming a July 14th Hells Gate 50% date.

Figure 6 reveals a slightly more complicated relationship between flow correlations and the distance and lag time between the lower Fraser and upriver sites. As with temperature, the correlation in flows was only sensitive to migration rate for sites > 300km upriver of Hope. However, the spatial trends were more variable. For instance, flows experienced by the fish at Hope were better correlated to flows experienced in the Quesnel River (~420km upriver) than those in the Chilcotin (~350km upriver), and to flows in the Stuart River (~770km upriver) than those in the Nechako (~570km upriver). In addition, even at high migration rates, there was still variability in the strength of correlation between lower and upper river flows as a function of site distance.

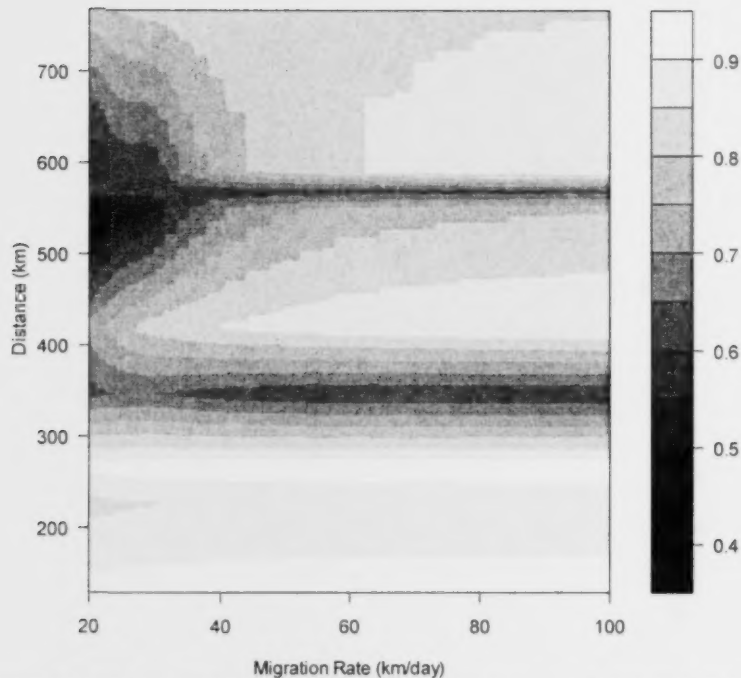


Figure 6. Correlations (Pearson's r) between 31-day average flows in the lower Fraser and temperatures at upriver EWatch sites as a function of distance from the Fraser at Qualark temperature station (km) and migration rate (km/day). Assuming a July 14th Hells Gate 50% date.

Seasonality

The influence of seasonal variability on the correlation between temperatures and flows experienced by Fraser sockeye salmon was explored in the context of assumed shifts in arrival timing into the Fraser River. The strength of the correlation in environmental conditions varied seasonally and was site-specific (Figures 7 and 8). In general, the correlation between Qualark temperatures and temperatures experienced upriver was higher earlier in the summer season and then deteriorated towards late August (Figure 7). However, the interpretation of the late-season correlations was somewhat confounded by decreased sample sizes in mid-September for some site comparisons (i.e. some stations were only monitored until early September during some years). There was also a general trend towards decreased correlation in flow conditions as the summer progressed (Figure 8) (flows are recorded year-round, thus there was no sample-size variability confounding interpretation of the results).

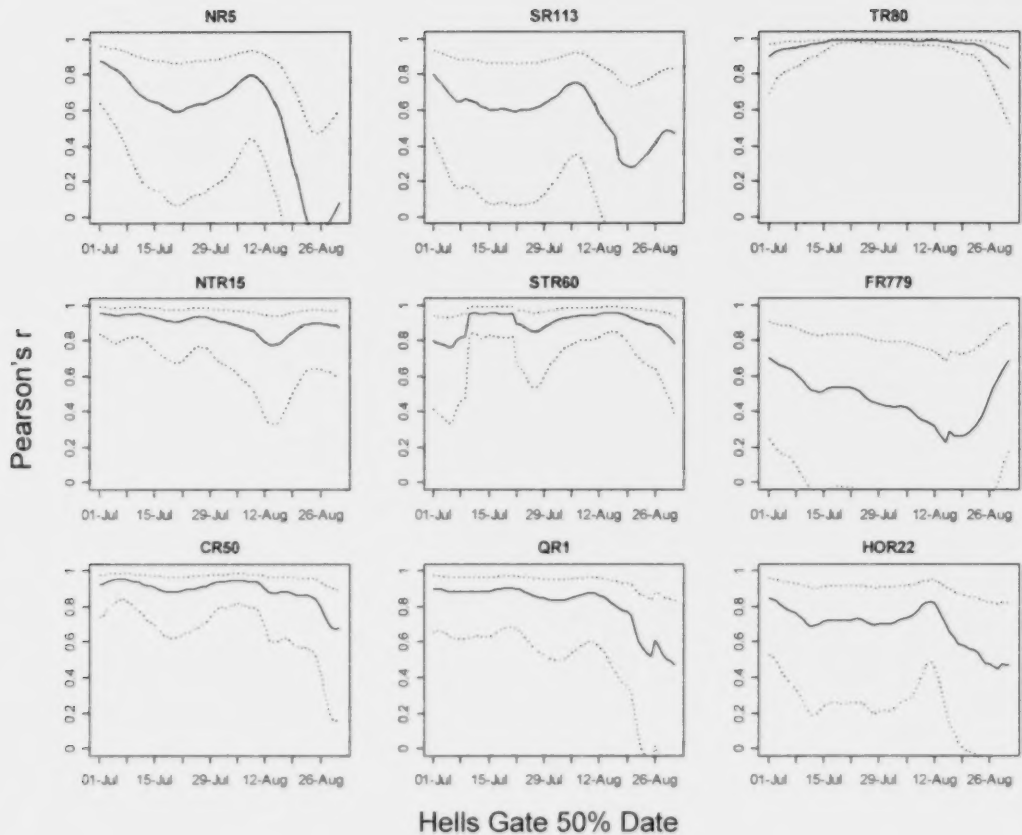


Figure 7. Seasonal changes in the correlation of river temperatures between the Fraser River at Qualark (FR190) and nine sites located upriver (see Table 2 for full site names). Correlations between 31-day average temperatures for each pair of sites were calculated for each Hells Gate 50% date using years of data from 1995 – 2007. The figures show the mean Pearson's r correlation coefficient (solid line) and associated 95% confidence intervals (dashed lines). Assuming a 42km/day migration rate.

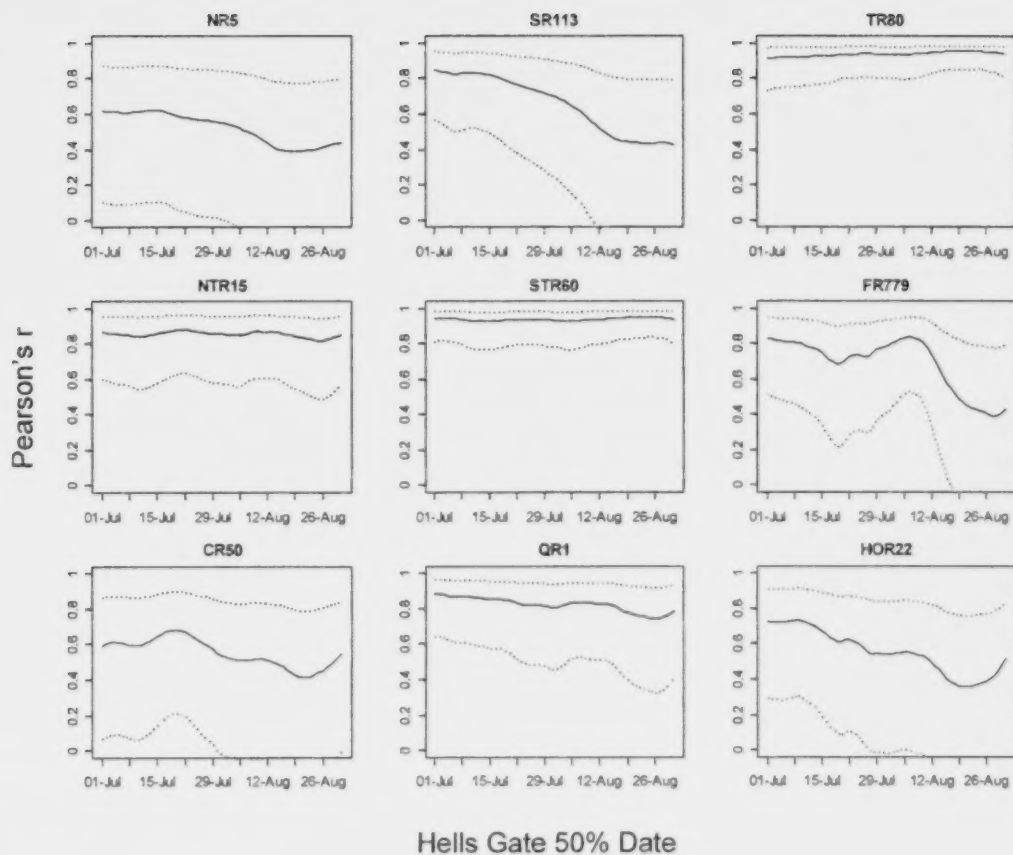


Figure 8. Seasonal changes in the correlation of river flows between the Fraser River at Qualark (FR190) and nine sites located upriver (see Table 2 for full site names). Correlations between 31-day average flows for each pair of sites were calculated for each Hells Gate 50% date using years of data from 1995 – 2007. The figures show the mean Pearson's r correlation coefficient (solid line) and associated 95% confidence intervals (dashed lines). Assuming a 42km/day migration rate.

DISCUSSION

IS THE LOWER FRASER AN APPROPRIATE SURROGATE?

In general, we observed reasonably strong correlations between lower Fraser (Qualark and Hope) temperature and flow values and environmental conditions at most of the nine upstream temperature and flow stations (Pearson's $r \geq 0.60$) after adjusting for passage times of Fraser River sockeye salmon. However, our analysis also suggests that the lower Fraser River environment is not always representative of conditions migrating sockeye salmon will experience elsewhere in the river system. The current biological rationale underlying sockeye salmon Management Adjustment models assumes that the conditions in the lower Fraser are indicative of the environmental exposures experienced by returning salmon along their entire migration route. However, this assumption becomes less defensible with increasing distance and/or slower migration times among sites. Results of the sensitivity analyses suggest the trend in decreasing correlations as a function of distance is often confounded by the increased time lag between more distant stations. Therefore, environmental conditions at a given point in time may be well correlated, but because of the time delay between sites due to migration times, adult salmon may encounter a range of uncorrelated exposures en route to their spawning grounds. Preliminary analyses (not shown here) also suggest that the degree of correlation among sites is sensitive to inter-annual variability. These results suggest that fisheries managers may want to consider Management Adjustment models which incorporate data based on summer temperature and flow data at several Fraser River Basin sites (e.g. multi-site or cumulative exposure models) rather than using lower Fraser River conditions exclusively.

The ANOVA results also revealed significant differences in temperature and flow as a function of site. For example, Qualark temperatures do not always reflect the warmest conditions fish experience during their journey to upriver spawning grounds (Figure 2). Early Stuart and Early Summer fish will typically encounter the warmest conditions just prior to spawning, as they enter the Nechako and/or Stuart Rivers (also see Macdonald et al. 2007). Exposure to extreme temperatures can result in a range of physiological consequences which may contribute to alterations in swimming performance (Lee et al. 2003; Goniea et al. 2006; Salinger and Anderson 2006; Keefer et al. 2008) and/or decreased probability of migration success (Macdonald et al. 2000; Patterson et al. 2007b; Crossin et al. 2008). Therefore, managers may also want to consider exploring alternative Management Adjustment models in which the escapement discrepancies are a function of the most extreme migration conditions experienced by each run-timing group, instead of conditions in the lower Fraser. Although data was insufficient to explore such alternatives several years ago, there is now a time series of at least 13 years for several locations through the Fraser Basin and these analyses are more feasible.

SPATIO-TEMPORAL SYNCHRONY IN RIVER ENVIRONMENT

Results revealed spatial and temporal synchrony in correlation strength between Qualark temperatures and temperatures at other Fraser Basin locations, supporting our

a priori hypotheses. Correlations were strongest when temperatures at different sites were measured close in time, and among sites in close proximity. However, even upriver temperatures were well-correlated to Qualark values when travel time between sites was assumed to be negligible. This synchrony suggests that summer river temperatures are controlled by large-scale processes, thus influencing conditions throughout the majority of the basin at the same time. Similar patterns were also observed for river flows, although correlation strength did not consistently increase as a function of decreasing distance. In addition, there was evidence of latitudinal differences in correlation between flows even when lag time was minimised.

The large scale spatio-temporal correlations in river environment observed here are consistent with other studies of the Fraser River Basin (e.g. Gilhousen 1990; Foreman et al. 2001). Because the Fraser is a snowmelt dominated system during the summer months, it was unsurprising to note large-scale correlation in flows; this observation was consistent with a relationship between Hope flows and snowmelt contributions to river volume (Patterson and Hague 2007). Summer river temperatures, meanwhile, are correlated to multiple factors including: drainage area, glacial and freshwater cover, river flow and macroclimate (e.g. air temperature and precipitation) (Moore 2006). Latitude, longitude and stream elevation have also been identified as important predictor variables for river temperature, although these factors appear redundant with the inclusion of macroclimate variables (Moore 2006). Previous studies have shown strong correlations between historic air temperature anomalies for the south coast BC mountains and river temperatures at Qualark, as well as between river temperatures and river volume attributable to snowmelt (Patterson and Hague 2007). As a result, climate change models applying global downscaling procedures still provide reasonable predictions of Fraser River temperatures and flows, despite the use of large-scale criteria as model inputs (Cannon and Whitfield 2002; Morrison et al. 2002; Ferrari et al. 2007).

However, variability in temperatures and flows among sites throughout the basin can also result from localised weather events (Foreman et al. 2001; Morrison and Foreman 2005). For example, Foreman et al. (2001) found that air temperatures measured at Prince George were well-correlated to river temperatures for reaches as far south as Quesnel, but that Kamloops air temperatures were better predictors of river temperatures for regions in the Thompson and lower Fraser. Lake-headed systems (e.g. Chilcotin, Quesnel, and Nechako) may also be influenced by localised conditions (Foreman et al. 2001). In addition, the interpretation of the disconnect between flows and temperatures in the Nechako River and those in the lower Fraser is confounded due to the controlled release of flows from a hydroelectric dam on the Nechako (Mitchell et al. 1995; Triton Environmental Ltd. 2006; Macdonald et al. 2007).

SEASONALITY IN ENVIRONMENTAL CORRELATIONS

Patterns in spatial synchrony in environmental conditions deteriorated over the course of the summer season. Similar decreases in correlation strength between lower and upriver temperatures were also observed in earlier studies (Gilhousen 1990). In general, the relationship between water temperature and regional air temperature anomalies,

river flow, or snowpack volume weakens over the course of the summer (Patterson and Hague 2007). The same seasonal trend is also observed for the relationship between Hope flows and snowpack volume (Patterson and Hague 2007). These results suggest that later in the summer, river environments appear to be more strongly influenced by synoptic weather conditions such as daily air temperature and precipitation. Therefore, it was not surprising to see increases in correlation strength earlier in the season when conditions are expected to be more controlled by basin-wide processes such as the spring freshet. However, it is important to note that these declining seasonal trends may not be consistent over all timeframes of interest. Additional years of monitoring may help to strengthen our interpretation of the seasonality variability in temperature and flow correlation strength.

RECOMMENDATIONS

The results of our analysis revealed that although there are strong correlations among some Fraser River locations, lower Fraser temperature and flow variables do not always capture a large (e.g. $r > 0.8$) proportion of the variance in river environmental conditions at all upriver locations. In addition, the strength of many of these correlations is sensitive to changes in arrival timing (seasonality), spatial proximity, and migration speed (lag-time between measurements). These analyses provide a baseline for further exploration of multi-site, alternate-site and/or cumulative exposure models to describe the relationship between in-river adult sockeye salmon loss and environmental conditions. By selecting models which better reflect the biological reality underlying the relationship between environmental exposure and in-river losses, researchers may be able to improve the accuracy of in-river escapement discrepancy predictions, thus increasing the probability of achieving management objectives. Future analyses of multi-site data should also explore the validity of replacing missing values or extending time series using datasets from alternative locations. Although not the purpose of this technical report, the increased correlation in 31-day means when lag time was minimised indicates potential for such applications.

ACKNOWLEDGEMENTS

Funding for this report was provided by the Pacific Salmon Treaty Research Fund, the Southern Endowment Fund (Project: Improvements to Environmental Management Adjustments), and the DFO Fraser River Environmental Watch Program (http://www-sci.pac.dfo-mpo.gc.ca/fwh/index_e.htm). Flow data was provided by the Environment Canada Water Survey of Canada program (<http://scitech.pyr.ec.gc.ca/waterweb/>). We would also like to thank Herb Herunter (DFO) and Ian Guthrie (Pacific Salmon Commission) for reviewing earlier versions of this report and providing helpful comments.

EXECUTIVE SUMMARY

- **Purpose:** determine whether lower Fraser River summer temperature and flow conditions are representative of environmental conditions throughout the river basin and are an appropriate surrogate for average river temperature and flow exposures experienced by returning adult sockeye salmon
- **Report objectives:**
 - compile available temperature and flow information
 - compile estimates of Fraser sockeye migration rates from the literature
 - examine correlation among 31-day mean temperature/flow conditions across different sites and different years
 - test for significant differences in river environments as a function of site and year
 - perform sensitivity analyses on seasonality and lag time between locations
- **Result summary:**
 - mean conditions at different sites were lagged by approximate sockeye run-group specific migration times
 - lower Fraser conditions were best correlated to conditions in the Thompson system
 - lower river temperatures were well-correlated to temperatures for most sites (general trend of correlation decreasing with distance)
 - poor correlations (Pearson's $r < 0.4$): (a) Fraser at Shelley (both temperature and flow) (b) Chilcotin (flow) (c) Horsefly (flow)
 - shorter lag time (faster migration rate) and earlier timing led to general increases in temperature and flow correlations
- **Take home messages:**
 - lower Fraser temperatures are generally well-correlated ($r > 0.6$) to conditions experienced by sockeye salmon at other locations, with some exceptions
 - salmon experience varying magnitudes of temperature and flow along their migration route
 - strength and/or direction of relationship among environmental conditions at different sites varies as a function of year, distance, lag time, and river entry date
- **Future research:**
 - incorporate multi-site data into a cumulative exposure model
 - test Management Adjustment models using environmental predictor variables consisting of temperatures/flows from upriver sites, or using accumulated thermal units
 - determine whether multi-site and/or cumulative exposure models provide a better fit to historic upriver lower-river sockeye escapement discrepancy data

LITERATURE CITED

- Barnes, D.P., and Walthers, L.C. 1997. Water temperatures at selected sites in the Fraser River Basin during the summer and fall of 1996. Can. Data Rep. Fish. Aquat. Sci. 1013:1-64.
- Barnes, D.P., and Magnusson, V.E. 2000. Water temperatures at selected sites in the Fraser River Basin from 1997 to 1999. Can. Data Rep. Fish. Aquat. Sci. 1071:1-226.
- Blackbourn, D.J. 1987. Sea surface temperature and pre-season prediction of return timing in Fraser River sockeye salmon (*Oncorhynchus nerka*). Can. Spec. Pub. Fish. Aquat. Sci. Vol 96: 296 – 306.
- Brett, J.R. 1995. Energetics. In: Physiological ecology of Pacific salmon. Eds. Groot, C., Margolis, L., and Clarke, W.C. UBC Press, Vancouver. Pp. 1-68.
- Brown, T.J., Barnes, D.P., and Walthers, L.C. 1998. Water temperature at selected sites in the Fraser Basin during the summer of 1995. Can. Data Rep. Fish. Aquat. Sci. 1039:1-50.
- Cannon, A.J., and Whitfield, P.H. 2002. Downscaling recent streamflow conditions in British Columbia using ensemble neural network models. J. Hydrol. Vol 259: 136-151.
- Crossin, G. T., Hinch, S. G., Cooke, S. J., Welch, D. W., Patterson, D. A., Jones, S. R. M., Lotto, A. G., Leggatt, R. A., Mathes, M. T., Shrimpton, J. M., Van Der Kraak, G. and Farrell, A. P. 2008. Exposure to high temperature influences the behaviour, physiology, and survival of sockeye salmon during spawning migration. Can. J. Zool. Vol 86: 127-140.
- English, K.K., Koski, W.R., Sliwinski, C., Blakley, A., Cass, A., and Woodey, J. 2003. Migration timing and in-river survival of Late-run Fraser River sockeye using radio-telemetry techniques. Prepared by LGL Limited Environmental Research Associates (Sidney, BC) for Fisheries and Oceans Canada (Nanaimo, BC).
- English, K.K., Sliwinski, C., Labelle, M., Koski, W.R., Alexander, R., Cass, A., and Woodey, J.C. 2004. Migration timing and in-river survival of Late-run Fraser River sockeye in 2003 using radio-telemetry techniques. Prepared by LGL Limited Environmental Research Associates (Sidney, BC) for Fisheries and Oceans Canada (Nanaimo, BC).
- English, K.K., Koski, W.R., Sliwinski, C., and Blakley, A. 2005. Migration timing and in-river survival of Late-run Fraser River sockeye using radio-telemetry techniques. Trans. Am. Fish. Soc. Vol 134: 1342-1365.

- Farrell, A.P., Hinch, S.G., Cooke, S.J., Patterson, D.A., Crossin, G.T., Lapointe, M., and Mathes, M.T. 2008. Pacific salmon in hot water: applying metabolic scope models and biotelemetry to predict the success of spawning migrations. *Physiol. Biochem. Zool.* Vol 82: 000-000.
- Ferrari, M.R., Miller, J.R., and Russell, G.L. 2007. Modeling changes in summer temperature of the Fraser River during the next century. *J. Hydrol.* Vol 342: 336-346.
- Foreman, M.G.G., Lee, D.K., Morrison, J., Macdonald, S., Barnes, D., and Williams, I.V. 2001. Simulations and retrospective analyses of Fraser watershed flows and temperatures. *Atmos. Ocean.* Vol 39 (2): 89-105.
- Gable, J., and Cox-Rogers, S. 1993. Stock Identification of Fraser River sockeye salmon: methodology and management application. PSC Tech. Rep. No. 5.
- Gilhousen, P. 1990. Prespawning mortalities of sockeye salmon in the Fraser River system and possible causal factors. XXVI, IPSFC, Vancouver, BC.
- Gonia, T.M., Keefer, M.L., Bjornn, T.C., Peery, C.A., Bennett, D.H., and Stuehrenberg, L.C. 2006. Behavioural thermoregulation and slowed migration by adult fall Chinook salmon in response to high Columbia River water temperatures. *Trans. Am. Fish. Soc.* Vol 135: 408-419.
- Hague, M.J., and Patterson, D.A. 2007. Quantifying the sensitivity of Fraser River sockeye salmon (*Oncorhynchus nerka*) management adjustment models to uncertainties in run timing, run shape and run profile. *Can. Tech. Rep. Aquat. Sci.* 2776: vii + 55 p.
- Hinch, S.G., and Rand, P.S. 1998. Swim speeds and energy use of upriver migrating sockeye salmon (*Oncorhynchus nerka*): role of local environment and fish characteristics. Optimal swimming speeds and forward assisted propulsion: energy-conserving behaviours of upriver-migration adult salmon. *Can. J. Fish. Aquat. Sci.* Vol 55: 1821-1831.
- Hinch, S.G., and Rand, P.S. 2000. Optimal swimming speeds and forward assisted propulsion: energy-conserving behaviours of upriver-migration adult salmon. *Can. J. Fish. Aquat. Sci.* Vol 57: 2470-2478.
- Hodgson, S., Quinn, T.P., Hilborn, R., Francis, R.C., and Rogers, D.E. 2006. Marine and freshwater climatic factors affecting interannual variation in the timing of return migration to freshwater of sockeye salmon (*Oncorhynchus nerka*). *Fish. Oceanogr.* Vol 15(1): 1-24.

- Keefer, M. L., Peery, C. A. & Heinrich, M. J. 2008. Temperature-mediated en route migration mortality and travel rates of endangered Snake River sockeye salmon. *Ecol. Fresh. Fish.* Vol 17: 136-145.
- Killick, S.R. 1955. The chronological order of Fraser River sockeye salmon during migration, spawning and death. International Pacific Fisheries Commission Bulletin VII.
- Lauzier, R., Brown, T. J., Williams, I. V. and Walthers, L. C. 1995. Water temperature at selected sites in the Fraser River Basin during the summers of 1993 and 1994. In Canadian Data Report of Fisheries and Aquatic Sciences Vol 956, pp. 1-86. West Vancouver, BC: Fisheries and Oceans Canada.
- Lee, C.G., Farrell, A.P., Lotto, A., MacNutt, M.J., Hinch, S.G., Healey, M.C. 2003. The effect of temperature on swimming performance and oxygen consumption in adult sockeye (*Oncorhynchus nerka*) and coho (*O. kisutch*) salmon stocks. *J. Exp. Biol.* Vol 206: 3239-3251.
- McKinnell, S., Freeland, H.J., and Groulx, S.D. 1999. Assessing the northern diversion of sockeye salmon returning to the Fraser River, BC. *Fish. Oceanogr.* Vol 8(2): 104-114.
- Macdonald, J.S. 2000. Mortality during the migration of Fraser River sockeye salmon (*Oncorhynchus nerka*): a study of the effect of ocean and river environmental conditions in 1997. *Can. Tech. Rep. Fish. Aquat. Sci.* 2315: 120 p.
- Macdonald, J.S., Foreman, M.G.G., Farrell, T., Williams, I.V., Grout, J., Cass, A., Woodey, J.C., Enzenhofer, H., Clarke, W.C., Houtman, R., Donaldson, E.M., and Barnes, D. 2000. The influence of extreme water temperatures on migrating Fraser River sockeye salmon (*Oncorhynchus nerka*) during the 1998 spawning season. *Can. Tech. Rep. Fish. Aquat. Sci.* 2326: 117 p.
- Macdonald, J.S., Morrison, J., Patterson, D.A., Heinonen, J., and Foreman, M. 2007. Examination of factors influencing Nechako River discharge, temperature and aquatic habitats. *Can. Tech. Rep. Fish. Aquat. Sci.* 2773: 32 p.
- Mitchell, A.C., James, C.B., and Edinger, J.E. 1995. Analysis of flow modification on water quality in Nechako River. *J. Energ. Eng.* Vol 121 (2): 73-80.
- Moore, R.D. 2006. Stream temperature patterns in British Columbia based on routine spot measurements. *Can. Wat. Res. J.* Vol 31 (1): 41-56.
- Morrison, J., Quick, M.C., Foreman, M.G.G. 2002. Climate change in the Fraser River watershed: flow and temperature projections. *J. Hydrol.* Vol 263: 230-244.

- Morrison, J., and Foreman, M.G.G. 2005. Forecasting Fraser River flows and temperatures during upstream salmon migration. *J. Environ. Eng. Sci.* Vol 4: 101-111.
- Naughton, G.P., Caudill, C.C., Keefer, M.L., Bjornn, T.C., Stuehrenberg, L.C., and Peery, C.A. 2005. Late-season mortality during migration of radio-tagged adult sockeye salmon (*Oncorhynchus nerka*) in the Columbia River. *Can. J. Fish. Aquat. Sci.* Vol 62: 30-47.
- Patterson, D.A., and Hague, M.J. 2007. Long range summer forecasts of lower Fraser River flow and temperature conditions. *Can. Tech. Rep. Fish. Aquat. Sci.* 2754: 34 p.
- Patterson, D.A., Macdonald, J.S., Skibo, K.M., Barnes, D., Guthrie, I., and Hills, J.A. 2007a. Reconstructing the summer thermal history for the lower Fraser River, 1941 to 2006, and implications for adult sockeye salmon (*Oncorhynchus nerka*) spawning. *Can. Tech. Rep. Fish. Aquat. Sci.* 2724: 33 p.
- Patterson, D.A., Skibo, K.M., Barnes, D.P., Hills, J.A., and Macdonald, J.S. 2007b. The influence of water temperature on time to surface for adult sockeye salmon carcasses and the limitations in estimating salmon carcasses in Fraser River, British Columbia. *N. Am. J. Fish. Manage.* Vol 27: 878-884.
- Quinn, T.P., Hodgson, S., and Peven, C. 1997. Temperature, flow, and the migration of adult sockeye salmon (*Oncorhynchus nerka*) in the Columbia River. *Can. J. Fish. Aquat. Sci.* Vol 54: 1349-1360.
- Rand, P.S. and Hinch, S.G. 1998. Swim speeds and energy use of upriver-migration sockeye salmon (*Oncorhynchus nerka*): simulating metabolic power and assessing risk of energy depletion. *Can. J. Fish. Aquat. Sci.* Vol 55: 1832-1841.
- Rand, P.S., Hinch, S.G., Morrison, J., Foreman, M.G.G., MacNutt, M.J., Macdonald, J.S., Healey, M.C., Farrell, A.P., Higgs, D.A. 2006. Effects of river flow, temperature and future climates on energetics and mortality of adult migrating Fraser River sockeye salmon. *Trans. Am. Fish. Soc.* Vol 135: 655-667.
- Robichaud, D. and English, K.K. 2006. Assessing in-river migration behaviour and survival of Summer-run sockeye salmon caught and released in the Lower Fraser River in 2005. Prepared by LGL Limited Environmental Research Associates (Sidney, BC) for the Pacific Salmon Commission (Vancouver, BC).
- Salinger, D.H. and Anderson, J.J. 2006. Effects of water temperature and flow on adult salmon migration swim speed and delay. *Trans. Am. Fish. Soc.* Vol 125: 188-199.

- Thomson, K.A., Ingraham Jr., W.J., Healey, M.C., LeBlond, P.H., Groot, C., and Healey, C.G. 1994. Computer simulations of the influence of ocean currents on Fraser River sockeye salmon (*Oncorhynchus nerka*) return times. Can. J. Fish. Aquat. Sci. Vol 51: 441-449.
- Triton Environmental Consultants Ltd. 2006. Summer water temperature and flow management project. Prepared for: Nechako Fisheries Conservation Program. Tech. Rep. no. RM05-1.
- Wagner, G.N., Hinch, S.G., Kuchel, L.J., Lotto, A., Jones, S.R.M., Patterson, D.A., Macdonald, J.S., Van Der Kraak, G., Shrimpton, M., English, K.K., Larsson, S., Cooke, S.J., Healey, M.C., and Farrell, A.P. 2005. Metabolic rates and swimming performance of adult Fraser River sockeye salmon (*Oncorhynchus nerka*) after a controlled infection with *Parvicapsula minibicornis*. Can. J. Fish. Aquat. Sci. Vol 62: 2124-2133.
- Woodey, J.C. 1987. In-season management of Fraser River sockeye salmon (*Oncorhynchus nerka*): meeting multiple objectives. In: Sockeye salmon (*Oncorhynchus nerka*) population biology and future management. Eds. Smith, H.D., Margolis, L., and Wood, C.C. Canadian Special Publication of Fisheries and Aquatic Sciences. 96, pp. 367-374.

APPENDIX A – MULTI-SITE TEMPERATURE DATA

Table A1. Daily mean summer temperature data for Fraser River at Qualark/Hells Gate (FR190) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA. For full description of this dataset see Patterson et al. 2007a.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	13.9	11.1	11.0	14.1	10.1	11.3	11.7	10.5	11.6	12.1	14.2	NA	12.2
02-Jun	13.8	11.8	11.0	13.6	10.2	11.4	11.1	10.4	11.9	12.5	13.7	NA	12.4
03-Jun	13.6	12.1	10.9	13.5	10.6	11.7	11.1	10.2	11.8	12.8	13.4	NA	12.7
04-Jun	13.6	12.0	10.7	13.6	10.9	12.3	11.1	10.5	11.9	13.2	13.2	NA	12.9
05-Jun	13.4	12.1	10.5	13.9	10.8	12.9	11.4	11.0	12.1	13.5	12.9	NA	12.9
06-Jun	13.2	12.0	10.5	14.4	10.7	12.7	11.7	10.8	12.2	13.8	12.6	13.0	12.6
07-Jun	12.5	12.6	10.7	14.2	10.5	12.9	11.8	11.1	12.6	14.2	13.1	12.9	12.0
08-Jun	12.7	12.7	10.9	14.4	10.9	13.2	12.0	10.8	13.2	13.8	12.6	12.7	12.0
09-Jun	13.1	12.0	11.2	14.9	10.6	13.1	12.4	10.4	13.5	14.0	13.1	12.4	12.0
10-Jun	13.1	11.7	11.3	15.6	10.6	12.3	12.6	10.4	13.8	13.7	13.7	12.8	11.7
11-Jun	13.5	11.8	11.6	16.1	10.5	11.9	12.2	10.9	13.4	13.2	13.8	13.3	10.3
12-Jun	13.7	12.1	11.8	16.1	10.9	11.9	12.0	11.4	13.7	13.5	14.0	13.9	10.8
13-Jun	13.8	12.0	12.0	15.9	11.4	12.2	12.0	12.2	13.6	14.1	13.9	14.2	11.0
14-Jun	13.7	11.9	12.5	15.6	11.9	12.0	12.4	12.9	13.5	14.0	13.8	14.0	11.0
15-Jun	13.9	11.7	12.7	15.2	12.4	12.0	12.4	13.2	13.3	13.8	13.7	NA	11.3
16-Jun	14.3	11.8	12.6	14.7	12.8	11.9	12.6	13.4	13.6	13.6	14.1	NA	11.5
17-Jun	14.2	12.2	12.5	14.7	12.8	11.9	12.9	13.2	13.7	14.0	14.3	NA	11.8
18-Jun	14.2	12.0	12.4	14.7	13.0	12.2	12.9	13.0	14.1	14.3	13.5	NA	12.2
19-Jun	14.1	12.0	12.6	15.0	12.9	12.0	13.1	12.7	14.1	14.6	13.8	NA	12.5
20-Jun	14.4	12.2	12.7	15.0	12.7	12.4	13.8	12.6	14.0	15.0	14.9	13.7	13.5
21-Jun	14.5	12.3	12.5	15.1	12.5	13.0	14.1	12.4	13.8	15.5	15.5	14.0	13.4
22-Jun	15.2	12.6	12.2	15.9	12.3	12.8	14.5	12.5	13.6	16.4	15.7	14.5	12.9
23-Jun	15.9	13.0	12.2	16.5	11.9	12.8	14.5	12.6	13.7	16.7	15.6	14.8	12.9
24-Jun	15.8	13.6	12.2	16.9	11.7	12.8	14.6	13.0	14.0	17.3	15.7	14.8	13.1
25-Jun	15.7	13.5	12.7	16.8	11.6	12.7	14.4	13.5	14.3	17.4	15.7	15.1	13.2
26-Jun	15.8	13.7	13.3	16.5	11.7	13.1	14.4	14.0	14.5	17.5	15.2	NA	13.2
27-Jun	15.5	13.7	13.6	16.3	11.9	13.8	14.5	14.0	14.8	17.8	15.3	NA	13.7
28-Jun	15.5	13.7	13.7	16.8	11.9	14.6	14.5	13.8	15.1	17.9	15.1	NA	13.8
29-Jun	15.9	13.8	13.7	16.9	12.4	15.1	14.5	13.7	15.4	17.2	15.3	17.0	14.2
30-Jun	16.5	14.0	13.5	17.1	12.5	15.0	14.9	13.7	15.7	17.0	15.8	16.9	14.4
01-Jul	16.7	14.2	13.8	17.4	12.6	15.0	14.9	13.7	15.5	17.4	16.0	17.3	14.5
02-Jul	16.9	14.1	14.0	17.1	12.2	14.5	15.3	13.4	15.5	18.3	16.1	17.6	14.5
03-Jul	16.8	13.8	14.4	17.4	11.8	14.2	15.5	13.3	15.4	18.3	15.8	17.7	14.7
04-Jul	16.8	13.8	14.8	17.3	11.9	13.8	16.0	12.9	15.5	17.8	16.0	17.8	14.8
05-Jul	16.8	14.0	15.2	17.6	12.5	13.4	16.1	12.9	15.5	17.5	16.1	18.0	15.2
06-Jul	16.8	14.0	15.2	18.1	13.0	13.6	16.3	13.2	15.2	18.0	15.9	18.4	15.3
07-Jul	16.8	14.3	15.5	18.6	12.9	13.4	16.1	13.6	15.4	17.7	15.7	18.8	15.4
08-Jul	17.0	14.4	15.5	19.1	12.7	13.7	16.3	13.6	15.7	16.6	15.7	18.7	15.4
09-Jul	17.4	14.2	15.5	19.2	13.1	14.4	16.5	13.8	15.4	16.5	15.8	18.4	15.8
10-Jul	17.1	14.4	15.2	18.9	13.5	14.4	16.8	14.4	15.9	16.7	15.8	18.4	15.8
11-Jul	17.1	14.9	14.5	19.1	13.7	14.6	17.2	15.6	16.8	16.7	15.5	18.3	15.9
12-Jul	17.1	15.5	14.4	18.8	13.8	15.1	17.1	16.0	17.2	16.4	15.4	18.0	16.1
13-Jul	17.3	15.5	14.9	18.6	13.9	15.6	17.1	16.0	17.2	16.9	15.6	17.7	16.5

14-Jul	17.3	15.8	15.1	18.3	13.9	15.3	17.6	16.3	17.0	17.5	15.8	17.2	17.0
15-Jul	17.1	15.9	14.9	18.0	13.4	15.3	17.5	16.7	17.4	18.0	16.0	17.0	17.5
16-Jul	17.3	15.6	14.6	18.0	13.3	15.2	16.8	16.5	17.5	18.3	16.3	17.1	17.8
17-Jul	17.5	15.1	14.1	18.4	13.2	15.8	16.7	16.3	17.5	18.6	16.2	17.2	17.7
18-Jul	17.9	15.3	14.5	18.5	13.4	16.0	16.5	16.5	17.6	19.2	16.1	17.2	17.4
19-Jul	17.9	15.2	15.1	18.7	13.9	16.0	16.8	16.5	17.6	19.5	16.6	17.2	17.0
20-Jul	18.3	15.2	15.5	18.8	14.4	16.2	16.8	16.7	17.4	19.5	16.6	17.3	16.9
21-Jul	18.5	15.3	15.7	18.8	14.8	16.8	16.3	16.8	17.4	19.4	16.8	18.0	16.9
22-Jul	18.5	15.5	16.1	19.0	15.2	17.3	15.4	16.8	17.7	19.5	16.7	18.6	16.8
23-Jul	19.1	15.2	16.4	19.5	15.8	17.0	15.4	16.8	17.8	19.8	16.5	19.4	16.7
24-Jul	19.1	15.6	16.4	19.7	15.7	17.2	15.7	17.2	18.4	19.9	17.1	20.0	16.7
25-Jul	19.0	15.8	16.0	19.8	15.2	17.8	16.0	17.6	18.9	20.0	17.1	20.2	16.6
26-Jul	18.4	16.5	15.5	20.3	15.5	17.7	16.2	17.9	18.8	19.9	17.1	20.2	16.7
27-Jul	18.2	17.3	15.5	20.7	15.6	17.4	16.7	18.2	18.5	19.6	17.5	20.4	17.1
28-Jul	18.0	17.8	15.8	20.9	15.6	17.0	16.7	18.1	18.8	19.6	17.8	20.4	17.2
29-Jul	17.5	18.4	16.1	21.1	15.5	16.9	16.5	18.0	19.3	19.9	17.7	19.7	17.2
30-Jul	16.7	18.4	16.5	21.0	15.4	17.2	16.4	17.6	19.5	20.0	17.8	19.2	17.4
31-Jul	16.4	18.1	17.1	21.0	15.5	17.2	16.3	16.9	19.8	20.1	18.0	18.5	17.5
01-Aug	16.7	17.8	17.3	20.9	15.3	17.5	16.4	16.4	20.1	20.2	18.2	18.5	17.6
02-Aug	16.9	17.2	17.0	21.0	14.9	17.5	16.1	16.0	20.2	20.3	17.9	18.7	17.6
03-Aug	16.9	16.5	17.1	21.2	15.2	17.2	16.3	15.6	20.1	20.2	17.8	18.4	17.7
04-Aug	17.2	16.2	17.6	21.1	15.5	17.0	16.6	15.3	20.0	20.1	17.7	18.4	17.5
05-Aug	17.3	15.7	17.6	20.9	15.8	17.2	16.7	15.1	20.0	20.2	18.0	18.1	17.4
06-Aug	16.7	15.9	17.6	20.4	16.9	18.1	16.6	15.4	19.7	19.8	18.2	18.1	17.6
07-Aug	16.3	16.5	17.8	20.1	17.2	18.6	16.4	15.2	19.3	19.2	18.4	18.2	18.0
08-Aug	16.5	16.8	17.9	19.9	17.3	18.8	16.4	15.7	19.4	19.2	18.6	17.9	18.2
09-Aug	16.3	16.9	17.3	19.9	18.0	19.0	16.2	16.5	19.4	19.6	18.6	18.1	18.1
10-Aug	16.4	17.0	17.2	19.5	18.3	19.1	16.3	17.3	19.1	19.3	18.5	18.1	17.7
11-Aug	16.5	17.1	17.4	19.3	18.0	18.5	16.9	17.3	18.9	19.6	18.2	18.3	17.4
12-Aug	16.5	17.2	17.5	19.5	17.8	18.1	17.4	17.3	19.2	19.8	18.3	18.3	17.2
13-Aug	16.1	17.8	17.8	19.8	17.5	18.1	18.0	17.2	19.1	19.9	18.4	18.3	17.1
14-Aug	16.4	18.1	18.1	20.0	17.1	17.7	18.4	17.4	18.8	20.5	18.7	18.9	17.1
15-Aug	16.5	17.9	18.2	19.8	17.0	17.6	18.7	17.2	18.8	20.9	19.0	18.4	17.3
16-Aug	16.5	17.3	17.8	19.3	16.7	17.5	19.1	17.1	19.1	21.2	19.3	18.4	17.4
17-Aug	16.2	17.0	17.8	18.9	17.1	17.4	19.3	17.1	19.2	21.4	19.1	18.3	17.3
18-Aug	15.7	16.5	17.7	18.4	17.4	17.4	19.1	16.7	19.3	21.5	18.7	18.5	17.3
19-Aug	15.4	16.5	17.7	17.9	17.8	17.2	18.9	16.8	19.4	21.5	18.1	18.7	17.1
20-Aug	15.7	16.6	17.8	18.2	18.1	17.0	18.5	16.5	19.3	21.4	18.1	19.0	17.2
21-Aug	16.0	16.3	18.0	18.3	17.7	16.9	17.9	16.5	19.1	21.2	18.3	19.1	17.3
22-Aug	15.9	16.4	18.1	18.5	17.7	17.1	17.6	17.0	18.9	20.8	18.4	19.0	17.6
23-Aug	16.1	16.7	18.0	18.7	17.9	17.5	17.2	17.7	18.2	20.1	17.9	18.8	17.5
24-Aug	15.9	16.8	17.9	18.8	18.2	17.7	16.5	18.1	17.7	19.2	17.2	18.7	17.7
25-Aug	15.6	16.8	17.7	18.6	18.0	17.5	16.4	18.6	17.3	18.4	17.0	18.8	17.6
26-Aug	15.9	17.2	17.5	18.5	17.4	17.3	16.4	18.7	17.1	18.1	17.0	18.8	17.4
27-Aug	16.0	17.6	17.5	18.6	17.2	17.1	16.5	19.1	17.1	18.0	17.0	18.6	17.1
28-Aug	16.2	17.6	17.3	18.6	17.2	16.6	16.8	19.3	17.4	17.7	17.3	18.5	16.8
29-Aug	16.0	17.7	17.2	18.6	17.0	15.9	16.8	19.3	17.2	17.8	17.3	18.5	16.6
30-Aug	15.8	17.7	17.0	18.6	15.9	15.9	16.9	19.1	17.3	17.9	17.2	18.0	16.8
31-Aug	16.0	17.4	16.9	18.6	15.2	15.7	17.0	18.6	17.6	17.9	16.8	17.6	17.0
01-Sep	16.2	17.0	17.1	18.6	14.9	15.1	16.8	17.9	17.9	17.7	17.0	17.3	16.6

02-Sep	16.3	16.9	17.2	18.6	15.1	14.8	16.6	17.7	17.6	17.1	16.8	17.3	16.4
03-Sep	16.5	16.4	16.9	18.8	15.0	14.3	16.5	17.0	17.5	16.2	16.6	17.3	16.3
04-Sep	16.8	15.6	16.8	18.7	14.7	13.9	16.4	16.8	17.7	15.6	16.2	17.6	16.2
05-Sep	17.0	15.0	17.0	18.4	15.0	13.8	16.4	16.3	18.0	15.7	16.0	17.6	16.3
06-Sep	17.1	14.5	16.7	18.1	15.3	13.8	15.8	15.5	18.1	15.4	15.7	18.1	16.4
07-Sep	17.4	14.7	16.8	17.9	15.2	14.0	15.2	15.1	18.0	15.3	15.6	18.1	16.1
08-Sep	17.2	15.0	16.7	17.8	15.0	13.8	15.1	14.8	17.8	15.3	15.7	18.1	15.8
09-Sep	17.4	15.1	16.5	17.5	14.9	13.6	15.0	14.4	17.3	15.1	15.8	18.1	15.6
10-Sep	17.6	15.1	16.6	16.7	15.1	13.4	14.9	14.4	16.9	14.9	15.2	17.8	15.5
11-Sep	17.7	15.1	16.8	16.5	14.8	13.4	14.6	14.8	16.5	14.3	15.0	17.5	15.4
12-Sep	17.7	15.1	16.4	16.9	14.2	13.0	14.3	15.1	16.1	14.0	15.0	17.6	15.7
13-Sep	17.5	15.0	15.9	17.0	14.1	12.6	14.6	15.3	15.8	13.5	15.1	17.5	15.9
14-Sep	17.4	14.8	15.7	17.2	14.2	12.6	14.6	15.2	15.4	13.4	14.9	16.9	NA
15-Sep	17.4	14.5	15.5	16.9	14.4	12.7	14.8	15.2	14.9	13.1	14.7	15.4	NA
16-Sep	17.2	14.4	15.3	16.6	14.6	12.8	15.0	15.3	14.5	13.3	14.7	14.6	NA
17-Sep	16.4	14.2	15.0	16.3	14.9	13.4	15.2	14.2	13.2	14.6	14.1	14.6	NA
18-Sep	16.4	13.8	14.7	15.8	14.9	13.9	15.3	14.9	13.3	13.0	14.4	13.6	NA
19-Sep	16.1	13.6	14.2	15.5	14.9	14.3	15.5	14.8	13.2	12.5	14.1	13.7	NA
20-Sep	15.5	13.4	13.7	15.5	15.0	14.2	15.4	14.5	13.5	12.3	14.0	13.7	NA
21-Sep	14.6	13.1	13.8	15.4	15.3	13.8	15.0	13.9	13.5	12.1	13.8	13.5	NA
22-Sep	14.3	12.6	14.1	15.2	15.4	12.9	15.2	13.3	13.6	12.4	13.7	13.7	NA
23-Sep	14.2	12.3	14.4	15.1	15.4	12.2	15.6	12.5	13.5	12.7	13.1	13.9	NA
24-Sep	13.8	12.0	14.5	14.8	15.0	11.8	15.7	11.9	13.1	12.8	12.6	14.2	NA
25-Sep	14.1	12.1	14.8	14.9	14.2	11.8	15.6	12.1	13.0	12.8	12.4	14.1	NA
26-Sep	14.2	12.2	15.1	14.8	13.9	11.9	15.3	11.9	12.8	12.9	12.5	14.4	NA
27-Sep	14.2	12.5	14.5	14.5	13.1	12.2	14.9	11.7	12.5	12.7	12.8	14.7	NA
28-Sep	14.5	12.8	14.5	14.4	12.5	12.4	14.4	11.8	12.5	12.7	12.5	15.0	NA
29-Sep	14.3	13.0	14.5	14.4	12.2	12.6	14.1	12.0	12.9	12.8	12.3	15.0	NA
30-Sep	14.1	12.6	14.3	14.4	12.3	12.9	13.8	11.9	12.8	12.7	12.3	14.9	NA

Table A2. Daily mean temperature data for Thompson River at Ashcroft (TR80) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	NA	NA	9.6	11.2	10.0	10.4	11.7	9.5	NA	11.6	12.2	11.5	10.9
02-Jun	NA	NA	9.9	11.2	9.8	10.4	11.0	9.2	NA	11.8	11.6	11.5	11.2
03-Jun	NA	NA	9.7	11.7	10.1	10.1	11.4	9.1	NA	11.8	11.7	11.1	11.8
04-Jun	NA	NA	9.6	12.0	9.6	11.6	9.6	9.7	NA	12.1	11.9	11.2	12.0
05-Jun	NA	NA	9.4	13.3	9.9	12.0	10.4	9.8	NA	12.1	11.8	11.1	12.4
06-Jun	NA	NA	9.5	13.4	10.0	11.9	11.7	10.1	NA	13.4	11.9	11.4	11.2
07-Jun	NA	NA	9.4	12.8	10.6	12.3	11.0	10.8	NA	12.3	12.0	11.0	10.9
08-Jun	NA	NA	9.9	13.2	10.5	12.2	11.4	9.9	NA	11.3	11.1	11.2	11.0
09-Jun	NA	NA	9.8	14.0	10.3	11.6	12.1	9.7	NA	12.6	11.9	11.2	10.9
10-Jun	NA	NA	9.9	14.8	10.3	11.3	11.4	10.0	NA	12.4	11.9	11.4	11.0
11-Jun	NA	NA	10.4	14.1	10.0	11.2	11.7	10.0	NA	12.8	12.6	12.3	10.4
12-Jun	NA	NA	10.5	13.5	10.5	11.8	11.3	10.1	NA	13.4	12.5	12.9	10.7
13-Jun	NA	NA	10.4	13.8	10.9	11.3	10.8	11.3	NA	13.3	12.9	12.3	11.1
14-Jun	NA	9.7	10.3	14.1	11.1	11.1	10.5	11.7	NA	12.8	12.7	12.1	10.6
15-Jun	NA	9.7	10.8	14.3	11.2	10.7	10.6	11.8	NA	12.4	13.6	12.4	10.9
16-Jun	NA	10.4	11.4	13.3	11.3	10.3	11.3	12.0	NA	12.8	13.4	12.9	11.1
17-Jun	NA	10.7	12.1	13.8	11.5	10.6	11.0	11.9	NA	13.0	12.8	13.0	10.3
18-Jun	NA	10.7	11.7	14.5	11.9	11.2	11.3	11.7	NA	13.7	12.1	13.2	11.1
19-Jun	NA	11.0	11.9	14.1	11.9	11.2	11.7	11.7	NA	13.8	12.9	12.4	11.9
20-Jun	NA	10.7	11.5	13.7	12.3	11.4	12.6	12.1	NA	13.6	13.8	12.2	12.4
21-Jun	NA	11.2	11.6	14.3	12.2	11.8	12.7	12.0	NA	14.2	13.4	13.0	12.1
22-Jun	NA	11.5	11.9	15.2	11.3	12.2	12.8	11.7	NA	13.9	13.5	13.5	12.1
23-Jun	NA	12.6	11.3	15.5	11.1	12.1	12.7	11.5	NA	14.9	13.8	13.1	12.4
24-Jun	NA	12.5	11.4	15.6	11.1	11.8	12.9	12.4	NA	15.0	14.7	13.6	12.9
25-Jun	NA	12.5	12.0	15.6	11.1	12.0	13.2	13.2	NA	15.3	14.1	14.4	12.8
26-Jun	NA	12.5	12.7	15.2	11.3	12.6	13.7	13.1	NA	15.9	14.0	14.9	13.3
27-Jun	NA	12.5	12.9	14.9	11.2	13.8	14.4	12.8	NA	17.6	13.9	14.9	13.9
28-Jun	NA	12.2	12.8	15.0	11.6	14.1	14.7	13.0	NA	15.8	13.8	14.7	13.6
29-Jun	NA	12.5	12.4	15.4	12.1	14.4	14.2	13.6	NA	15.5	13.7	14.6	13.7
30-Jun	NA	12.5	12.7	16.3	11.9	13.9	14.1	13.1	NA	16.1	13.9	15.6	13.4
01-Jul	NA	12.5	12.4	15.8	11.3	13.5	13.5	13.0	NA	17.6	14.4	16.5	13.3
02-Jul	NA	12.5	12.7	15.8	10.6	13.2	13.9	12.6	NA	17.7	14.1	16.4	13.1
03-Jul	NA	12.5	13.2	15.5	10.7	13.5	14.8	12.7	NA	16.6	14.3	16.3	13.4
04-Jul	NA	12.8	14.1	16.1	11.1	13.6	14.9	12.3	NA	15.9	15.2	16.2	13.8
05-Jul	NA	13.0	14.0	17.0	11.6	14.1	14.6	12.8	NA	16.8	15.1	17.3	13.8
06-Jul	15.9	13.3	14.6	16.9	12.0	14.1	14.9	13.3	NA	17.6	15.3	18.2	13.7
07-Jul	16.3	13.8	14.2	17.2	11.9	13.6	15.9	13.3	NA	15.8	15.2	17.0	14.0
08-Jul	16.7	13.2	15.3	17.5	12.4	13.9	15.8	12.6	NA	15.7	15.3	16.8	14.6
09-Jul	16.3	13.2	14.8	17.2	12.9	13.9	15.8	12.8	NA	16.8	15.8	16.9	15.4
10-Jul	15.9	13.5	13.4	18.1	12.7	13.7	15.6	14.7	NA	16.9	14.8	17.0	14.7
11-Jul	15.6	14.2	13.1	18.1	12.2	14.1	15.5	14.8	NA	16.1	14.8	17.3	15.2
12-Jul	16.2	14.1	13.7	17.7	11.9	14.4	15.8	14.1	NA	16.6	14.9	17.5	16.1
13-Jul	16.5	13.9	13.8	17.8	12.5	14.2	17.5	14.7	NA	17.0	14.5	17.1	16.7
14-Jul	16.0	14.6	13.7	17.8	12.2	14.0	17.5	16.1	NA	17.4	14.6	16.8	17.4
15-Jul	16.0	14.4	14.1	18.2	12.7	14.0	15.9	15.4	16.8	17.2	15.5	16.5	17.4

16-Jul	16.5	14.4	13.8	19.0	13.0	15.0	15.6	14.9	16.7	17.1	15.6	16.5	16.4
17-Jul	16.9	15.3	13.7	18.0	12.6	15.7	16.1	15.4	16.4	17.4	14.5	16.9	16.6
18-Jul	17.1	15.4	14.7	17.6	12.7	14.9	16.7	15.9	17.1	17.3	15.4	17.1	16.4
19-Jul	17.3	14.6	15.0	17.6	13.4	14.5	16.7	15.8	16.8	17.8	15.6	17.1	17.1
20-Jul	17.9	14.6	15.1	17.3	13.9	14.9	16.1	15.6	16.8	17.9	15.8	17.8	17.2
21-Jul	17.9	14.8	15.2	17.7	13.8	16.2	15.4	15.7	16.7	18.1	16.1	18.5	17.2
22-Jul	17.6	14.0	15.7	18.7	14.8	15.9	15.3	15.7	17.1	18.7	15.8	18.6	16.8
23-Jul	18.0	14.3	15.6	19.4	14.6	15.4	15.8	16.8	17.6	18.9	17.3	18.4	16.8
24-Jul	18.8	14.2	15.2	18.6	14.1	15.8	15.9	17.3	17.3	19.2	16.7	18.7	16.0
25-Jul	18.6	14.7	14.1	18.5	14.5	16.9	15.4	16.8	17.3	19.1	15.9	18.0	15.7
26-Jul	18.8	16.3	14.3	19.2	15.0	17.3	16.0	16.7	18.4	18.1	16.5	18.9	16.7
27-Jul	17.9	16.7	15.6	19.5	14.7	16.2	17.2	16.8	18.9	18.2	17.7	18.9	16.5
28-Jul	18.6	17.3	15.8	20.3	14.2	16.3	16.6	17.2	18.2	19.1	17.1	18.9	16.2
29-Jul	17.7	17.6	15.6	20.2	14.1	16.8	16.4	17.5	18.4	19.3	16.5	19.6	16.5
30-Jul	16.4	16.0	16.7	20.4	14.6	16.2	16.3	17.1	19.0	19.4	17.0	19.1	16.6
31-Jul	17.3	16.4	16.4	20.0	14.6	16.0	16.3	16.3	19.8	19.4	18.0	19.2	16.4
01-Aug	17.9	16.7	14.8	19.5	15.0	15.7	16.3	16.8	NA	19.8	17.4	19.9	17.4
02-Aug	17.7	16.2	15.8	19.8	15.6	15.9	16.7	16.8	NA	20.0	16.8	19.1	18.5
03-Aug	18.1	16.4	17.2	21.0	15.4	16.0	17.1	16.3	NA	20.2	17.1	18.2	17.3
04-Aug	18.0	15.4	17.4	21.3	15.2	15.9	17.1	16.5	NA	20.9	18.2	19.0	16.8
05-Aug	17.0	15.1	17.1	20.8	16.2	17.1	16.4	16.3	NA	20.9	18.0	18.6	17.2
06-Aug	17.0	16.0	17.0	20.4	16.5	17.7	16.5	15.4	NA	20.2	17.7	19.4	17.9
07-Aug	17.6	16.6	17.0	20.5	15.9	17.4	16.0	15.9	19.8	19.6	17.3	19.2	18.4
08-Aug	17.1	16.4	15.7	20.7	16.4	17.7	15.6	16.8	19.9	19.6	17.6	18.4	17.9
09-Aug	16.4	16.5	16.2	20.6	17.1	18.3	15.5	17.1	19.6	19.4	17.9	18.2	17.3
10-Aug	16.5	16.7	17.1	20.2	16.9	17.5	16.1	16.8	18.9	19.8	17.9	18.5	17.5
11-Aug	16.5	16.1	17.4	20.3	16.5	17.3	16.8	16.4	19.4	20.2	17.7	17.7	17.9
12-Aug	15.7	17.0	17.8	20.4	16.8	17.6	17.5	16.5	19.5	20.3	18.2	17.7	18.0
13-Aug	15.9	17.6	17.3	20.3	17.1	17.4	17.3	16.9	19.2	20.4	18.7	18.9	17.9
14-Aug	16.2	16.9	17.0	20.1	17.2	18.0	17.3	16.4	19.5	20.5	19.1	19.0	17.6
15-Aug	16.2	16.6	16.3	20.2	16.6	18.3	17.9	16.6	19.9	21.0	19.4	18.7	17.9
16-Aug	15.7	16.8	16.4	20.1	17.0	18.0	18.4	17.1	19.4	20.9	19.5	18.1	18.2
17-Aug	14.7	16.5	17.8	20.6	17.2	17.9	18.4	16.9	18.6	20.5	18.9	18.3	18.0
18-Aug	14.1	16.9	18.5	20.4	17.5	17.7	17.9	17.3	19.5	20.4	18.0	18.7	18.0
19-Aug	NA	17.2	18.7	20.2	17.9	18.0	17.5	17.5	19.5	20.7	18.4	19.0	18.1
20-Aug	NA	17.2	18.9	20.2	17.2	17.8	17.8	16.7	18.9	20.8	19.3	18.9	17.9
21-Aug	NA	17.1	18.7	19.9	16.8	17.8	18.3	16.8	19.7	20.6	19.4	18.7	18.1
22-Aug	NA	17.4	18.1	20.2	16.9	18.0	19.0	17.3	19.6	20.0	18.3	19.2	18.3
23-Aug	NA	17.3	18.4	20.1	18.3	17.8	18.5	17.8	19.1	19.6	17.6	18.9	18.5
24-Aug	NA	17.0	18.5	19.6	18.1	17.5	17.7	18.3	18.5	20.1	17.5	18.2	18.5
25-Aug	15.2	17.3	18.3	19.6	17.4	17.5	16.7	18.0	18.6	19.9	17.8	19.1	18.0
26-Aug	15.5	17.8	18.6	19.6	17.3	17.7	16.7	18.5	19.2	19.0	18.3	19.3	17.5
27-Aug	15.8	17.5	18.4	19.7	17.5	17.5	17.0	18.5	18.9	19.3	18.5	19.5	17.2
28-Aug	15.7	17.3	18.0	19.7	18.4	17.1	16.5	18.7	18.3	19.5	18.4	19.0	17.2
29-Aug	15.2	18.4	17.7	20.0	17.6	17.8	16.7	18.5	18.5	19.3	17.9	18.9	18.0
30-Aug	15.3	17.8	17.5	19.4	16.5	17.8	17.3	17.9	18.9	19.1	17.7	18.2	18.6
31-Aug	15.5	17.3	17.7	18.9	16.1	17.1	17.6	17.5	19.0	18.4	18.0	17.7	17.3
01-Sep	15.9	17.7	17.9	19.4	16.5	16.2	17.3	18.4	18.4	17.6	18.3	18.5	17.4
02-Sep	15.8	18.0	18.0	19.8	16.9	16.2	16.9	18.6	18.2	16.7	18.4	19.0	17.6
03-Sep	15.8	17.9	17.2	19.5	16.6	15.9	17.4	18.3	18.8	17.5	18.0	19.1	17.7

04-Sep	16.0	16.9	18.1	19.0	16.5	16.2	17.4	17.4	19.0	17.3	17.6	19.0	17.9
05-Sep	16.1	16.2	18.3	18.7	17.0	16.4	16.8	16.6	18.9	17.0	17.2	18.6	17.3
06-Sep	16.6	16.8	18.1	19.4	16.6	16.6	16.4	16.9	18.9	17.1	17.4	18.8	16.8
07-Sep	15.9	16.9	17.9	19.6	15.6	16.3	16.2	17.0	18.9	17.5	17.3	18.0	16.8
08-Sep	15.5	16.6	17.8	19.4	15.9	16.1	16.2	16.9	18.5	17.4	17.5	18.5	16.7
09-Sep	16.0	16.3	17.9	18.5	16.4	15.9	16.2	16.9	18.0	16.6	16.6	18.1	16.6
10-Sep	16.4	16.7	17.9	18.4	15.8	15.6	16.2	17.2	17.7	17.1	16.0	18.1	17.1
11-Sep	16.4	17.1	17.3	19.1	14.8	15.2	15.9	16.8	18.0	16.5	15.9	18.3	17.6
12-Sep	16.0	NA	16.5	19.1	14.8	15.9	16.5	16.4	17.8	15.8	16.7	18.5	17.4
13-Sep	15.8	NA	16.8	19.0	15.3	16.2	16.7	16.7	17.1	15.3	16.7	17.5	16.1
14-Sep	16.3	NA	17.1	18.5	15.4	16.1	16.7	16.8	17.4	15.5	16.6	16.4	16.3
15-Sep	16.7	NA	17.3	18.6	15.6	15.9	16.5	16.9	16.9	15.8	16.4	16.2	16.7
16-Sep	15.4	NA	17.1	18.7	15.5	15.7	16.2	17.0	16.3	15.7	16.0	16.1	16.6
17-Sep	15.3	NA	16.6	18.3	15.1	15.3	16.3	16.7	15.6	14.8	15.9	15.9	16.5
18-Sep	15.8	NA	16.2	17.9	15.0	15.3	16.4	16.4	15.9	14.0	15.9	16.4	16.2
19-Sep	15.4	NA	15.3	18.0	15.2	15.1	16.2	16.2	16.2	13.9	16.0	16.4	15.7
20-Sep	14.4	NA	16.1	17.4	15.9	14.9	15.8	16.1	NA	14.4	15.8	16.1	15.6
21-Sep	15.1	NA	16.2	17.4	16.3	14.4	16.3	15.5	NA	14.7	15.6	15.6	15.4
22-Sep	15.3	NA	15.9	17.6	16.1	14.1	16.7	15.7	NA	14.8	15.3	15.5	15.5
23-Sep	15.6	NA	16.0	17.5	15.8	14.1	16.9	16.0	NA	14.3	14.7	15.8	15.2
24-Sep	15.6	NA	16.0	17.3	15.5	14.5	16.8	15.7	NA	14.4	14.4	16.1	14.3
25-Sep	15.5	16.5	16.7	15.5	14.7	16.5	14.6	14.6	13.9	14.6	16.2	16.2	14.5
26-Sep	15.3	16.0	16.1	14.5	14.7	16.4	14.4	14.4	13.7	15.0	16.3	16.3	NA
27-Sep	15.1	16.0	16.3	14.2	14.8	16.0	14.9	14.9	14.0	15.0	16.0	16.0	NA
28-Sep	15.2	15.8	16.7	14.3	14.8	15.9	15.0	15.0	13.9	14.5	16.0	16.0	NA
29-Sep	14.8	15.1	16.4	14.6	15.0	15.9	14.6	14.6	13.2	14.7	15.9	15.9	NA
30-Sep	14.3	15.6	16.5	14.8	14.9	15.9	13.8	13.8	12.9	14.6	15.7	15.7	NA

Table A3. Daily mean temperature data for North Thompson River at Rayleigh (NTR15) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	NA	NA	8.2	11.6	8.9	10.1	9.6	7.9	9.8	NA	10.4	10.7	10.3
02-Jun	NA	NA	8.2	11.2	8.3	10.4	9.4	8.5	9.7	NA	9.4	10.6	10.3
03-Jun	NA	NA	8.2	11.4	8.9	10.5	8.8	9.3	9.8	NA	9.8	10.1	10.8
04-Jun	NA	NA	8.0	11.5	9.5	11.3	8.9	9.7	10.0	NA	10.2	9.3	10.6
05-Jun	NA	NA	8.1	11.7	9.8	11.1	9.3	9.9	10.9	NA	10.7	9.4	9.9
06-Jun	NA	NA	8.4	12.0	8.6	9.8	10.0	9.0	11.4	NA	10.7	10.3	9.8
07-Jun	NA	NA	8.4	12.3	7.9	9.7	10.0	8.4	11.7	NA	10.1	10.5	9.2
08-Jun	NA	NA	8.7	13.4	8.1	9.6	9.8	8.2	12.0	NA	10.2	11.2	9.0
09-Jun	NA	NA	9.0	13.7	8.5	9.6	9.9	9.2	11.9	NA	11.3	11.4	9.3
10-Jun	NA	NA	9.3	13.7	8.5	9.8	9.3	10.3	11.4	NA	11.8	10.9	9.2
11-Jun	NA	NA	9.6	13.9	8.8	9.6	8.9	10.8	10.6	NA	12.1	11.1	10.1
12-Jun	NA	NA	9.6	13.7	9.7	9.7	9.5	10.6	11.0	NA	11.8	11.8	9.9
13-Jun	NA	NA	9.7	13.6	10.2	9.3	10.9	11.2	11.3	NA	11.9	12.3	9.7
14-Jun	NA	NA	10.0	13.4	10.4	9.3	10.8	11.0	11.4	NA	10.9	12.2	9.9
15-Jun	NA	10.3	10.2	12.9	10.8	9.5	10.7	10.7	11.1	NA	10.9	11.8	9.9
16-Jun	NA	10.3	10.4	12.7	11.0	9.6	10.5	10.8	11.2	NA	11.0	11.5	10.4
17-Jun	NA	10.4	10.4	12.7	10.7	10.3	10.8	10.9	11.8	NA	10.8	11.1	10.4
18-Jun	NA	9.7	10.3	12.3	10.9	10.8	11.3	10.3	12.6	NA	10.8	11.3	10.6
19-Jun	NA	9.3	9.9	13.0	10.5	10.8	12.1	9.8	12.7	NA	12.1	11.2	10.6
20-Jun	NA	9.7	9.8	13.2	9.7	10.4	12.3	9.8	12.3	NA	12.9	11.0	10.7
21-Jun	NA	10.2	9.7	13.9	9.3	10.6	12.4	10.5	11.2	NA	13.1	11.7	10.9
22-Jun	NA	10.9	9.8	14.7	9.4	10.9	13.1	11.2	11.1	NA	13.1	12.2	11.3
23-Jun	NA	11.0	10.1	15.1	9.6	11.0	12.8	11.7	11.2	NA	12.6	12.6	11.2
24-Jun	NA	10.9	10.1	14.8	9.6	11.2	12.2	11.7	11.8	NA	11.9	13.3	11.2
25-Jun	NA	10.8	10.2	14.2	9.2	11.9	12.2	11.7	12.4	NA	11.7	14.1	10.9
26-Jun	NA	10.7	10.6	13.5	9.7	12.3	11.8	11.6	12.9	NA	12.0	15.1	11.3
27-Jun	NA	11.0	10.9	13.6	9.9	12.6	11.9	11.8	13.5	NA	12.2	15.7	11.8
28-Jun	NA	10.9	10.9	13.9	10.5	13.0	11.9	11.5	13.7	NA	12.5	15.8	11.8
29-Jun	NA	11.0	10.9	14.2	10.6	12.6	12.8	11.2	13.8	NA	13.3	15.2	12.0
30-Jun	NA	10.6	11.0	13.9	9.8	12.2	13.1	10.7	14.1	NA	13.6	15.0	12.2
01-Jul	NA	10.9	11.2	14.5	10.1	12.3	13.6	10.5	14.1	NA	13.7	15.5	12.0
02-Jul	NA	11.6	11.4	14.9	10.0	12.1	13.9	10.7	12.6	NA	13.3	15.9	12.3
03-Jul	NA	12.0	11.7	15.2	9.8	11.6	14.0	11.0	12.4	NA	13.2	15.9	12.9
04-Jul	NA	12.1	12.1	15.4	9.5	11.3	14.7	11.1	12.9	NA	13.4	16.3	13.3
05-Jul	NA	11.2	12.4	16.1	10.4	11.6	15.0	11.1	12.8	NA	13.6	16.0	13.8
06-Jul	NA	11.0	12.5	15.5	11.0	11.9	14.5	11.2	12.9	NA	13.8	16.1	13.7
07-Jul	NA	11.4	12.5	15.7	10.7	12.5	13.9	12.0	13.9	NA	13.5	16.5	13.8
08-Jul	NA	12.2	12.2	16.1	10.4	12.5	14.3	12.5	14.6	NA	12.4	16.3	12.7
09-Jul	NA	12.6	11.7	16.4	10.6	12.4	14.8	13.2	14.3	NA	11.9	15.7	13.3
10-Jul	NA	12.4	11.7	16.7	11.1	12.1	15.4	14.0	14.4	NA	12.1	16.2	13.8
11-Jul	NA	12.3	11.5	16.8	11.8	12.3	16.0	14.5	15.1	NA	12.9	16.0	15.0
12-Jul	NA	12.4	11.1	16.4	12.2	12.7	15.6	14.9	16.2	NA	13.4	15.1	15.3

13-Jul	NA	13.2	10.9	15.4	12.5	13.1	15.1	14.2	16.7	NA	13.6	14.8	14.2
14-Jul	NA	13.8	11.0	14.4	11.9	13.2	14.9	13.4	15.5	NA	14.1	14.9	15.1
15-Jul	NA	14.1	11.3	14.2	10.9	12.7	14.4	13.9	15.0	NA	13.7	14.8	14.8
16-Jul	NA	13.9	11.4	14.8	10.9	12.7	13.9	14.1	15.0	NA	13.5	15.3	14.1
17-Jul	NA	12.5	11.7	15.3	11.8	13.3	14.1	14.3	15.4	NA	13.6	16.0	14.9
18-Jul	NA	11.8	11.9	16.0	12.7	14.1	13.8	14.0	15.5	NA	14.3	16.0	12.4
19-Jul	NA	12.1	11.9	16.7	13.4	14.7	12.5	14.2	15.4	NA	14.8	15.4	14.2
20-Jul	NA	11.7	12.1	16.6	13.6	14.8	11.9	14.3	16.1	NA	14.7	15.7	14.0
21-Jul	NA	11.4	12.4	16.5	13.4	14.6	12.5	14.2	16.8	NA	15.0	16.8	12.9
22-Jul	NA	12.3	12.7	16.7	13.6	14.2	13.9	14.6	17.4	NA	14.9	17.8	13.8
23-Jul	NA	13.2	12.9	17.4	13.6	13.7	14.7	15.0	17.6	NA	14.4	18.7	14.1
24-Jul	NA	14.2	12.8	17.8	12.8	14.0	14.7	15.8	17.3	NA	14.5	19.2	14.1
25-Jul	NA	15.0	12.6	18.2	12.2	13.4	15.0	16.1	17.0	NA	14.6	19.0	14.3
26-Jul	NA	15.1	12.4	18.5	12.8	13.5	15.1	16.3	17.2	NA	14.7	18.4	14.3
27-Jul	NA	15.0	12.4	18.7	13.3	13.9	14.7	15.8	17.7	NA	15.3	18.1	15.5
28-Jul	NA	15.2	12.5	18.9	14.1	13.8	14.5	15.3	18.2	NA	16.1	18.4	15.8
29-Jul	NA	15.7	12.8	18.9	14.5	13.5	14.2	14.9	18.2	NA	16.6	18.3	16.4
30-Jul	NA	15.7	13.0	18.6	14.2	13.6	13.8	14.6	18.4	NA	16.1	16.9	16.4
31-Jul	NA	15.6	13.3	18.3	13.4	14.2	13.9	13.7	18.2	NA	15.7	16.0	16.2
01-Aug	NA	14.9	13.5	18.4	13.3	15.2	14.1	13.4	18.2	NA	15.4	15.5	15.8
02-Aug	NA	14.0	13.6	18.7	14.0	15.3	14.3	13.5	18.4	NA	15.3	15.3	16.4
03-Aug	NA	13.3	13.7	18.7	14.6	15.3	14.0	13.5	18.5	NA	15.7	14.6	16.5
04-Aug	NA	13.1	13.8	18.5	14.7	15.6	14.2	14.2	18.6	NA	15.9	15.9	16.1
05-Aug	NA	12.6	13.8	18.7	14.8	15.8	14.0	14.4	18.2	NA	16.3	15.9	16.0
06-Aug	NA	12.8	14.0	17.6	14.7	16.1	14.0	14.4	18.1	NA	16.9	16.3	16.4
07-Aug	NA	13.4	14.1	17.3	15.0	16.3	14.2	14.8	17.2	NA	17.5	16.2	16.9
08-Aug	NA	14.1	14.2	17.1	15.1	16.2	14.5	15.4	17.0	NA	17.7	17.7	16.6
09-Aug	NA	14.8	14.3	17.0	15.2	16.4	14.9	15.7	17.1	NA	17.9	17.9	16.0
10-Aug	NA	15.4	14.2	17.2	15.0	16.4	15.5	16.3	17.2	NA	17.8	17.4	15.4
11-Aug	NA	15.4	14.1	17.1	15.3	15.8	15.9	16.1	16.9	NA	17.5	17.4	15.3
12-Aug	NA	15.4	14.2	16.8	15.0	15.7	16.4	16.3	17.1	NA	17.6	17.2	15.6
13-Aug	NA	15.5	14.3	17.6	14.8	15.1	16.8	16.5	17.2	NA	17.3	17.1	15.7
14-Aug	NA	15.6	14.3	18.3	14.9	15.1	16.9	17.0	17.3	NA	17.7	16.3	15.9
15-Aug	NA	15.7	14.5	18.4	14.7	15.1	17.2	16.9	17.1	NA	17.7	16.9	16.5
16-Aug	NA	15.5	14.6	17.6	14.4	15.5	17.2	16.5	17.1	NA	17.5	17.2	16.9
17-Aug	NA	15.1	14.6	16.7	14.8	15.6	17.4	15.8	17.6	NA	17.0	17.2	17.2
18-Aug	NA	14.7	14.7	16.1	15.0	15.4	17.0	15.4	18.0	NA	16.2	17.5	17.3
19-Aug	NA	14.3	14.7	15.4	15.4	14.7	16.6	15.3	17.4	NA	16.2	17.6	16.2
20-Aug	NA	14.0	14.7	15.7	15.8	14.1	15.6	15.4	16.9	NA	16.4	17.8	15.2
21-Aug	NA	13.6	14.7	16.3	16.0	14.3	14.9	15.6	16.4	NA	16.6	17.3	14.9
22-Aug	NA	13.7	14.8	16.7	15.5	14.8	14.5	16.1	16.3	NA	16.6	17.4	15.1
23-Aug	NA	14.2	14.8	17.1	15.4	15.5	14.6	16.7	16.0	NA	16.3	17.2	15.5
24-Aug	NA	15.0	14.8	17.1	15.7	16.3	14.7	17.5	15.6	NA	15.9	16.5	15.8
25-Aug	NA	15.7	14.7	17.1	15.9	16.6	14.0	18.0	15.3	NA	15.9	16.3	16.1
26-Aug	NA	15.9	14.6	16.8	15.6	16.3	13.9	17.8	15.5	NA	16.1	16.6	15.6
27-Aug	NA	15.8	14.5	16.7	15.1	15.2	14.7	17.5	15.7	NA	16.4	16.7	15.3
28-Aug	NA	15.7	14.5	16.7	15.0	13.9	15.7	17.1	16.1	NA	16.4	18.0	14.6
29-Aug	NA	15.8	14.4	16.7	15.2	13.6	16.1	16.9	16.4	NA	16.2	17.0	14.8

30-Aug	NA	16.1	14.4	16.9	15.0	14.1	16.1	16.9	16.7	NA	15.4	15.8	15.5
31-Aug	NA	15.4	14.3	17.0	14.1	14.4	16.2	16.7	17.0	NA	14.9	15.5	16.0
01-Sep	NA	14.5	14.3	16.8	13.2	14.2	15.8	16.0	17.0	NA	14.6	15.4	16.1
02-Sep	NA	14.0	14.3	16.2	12.7	13.4	15.1	15.4	16.7	NA	15.0	15.5	15.7
03-Sep	NA	13.5	14.4	16.5	13.0	13.1	14.6	14.7	16.5	NA	15.0	15.9	14.7
04-Sep	NA	13.2	14.5	16.6	13.0	12.9	14.2	13.9	16.6	NA	14.4	16.4	14.7
05-Sep	NA	13.2	14.6	16.8	12.8	12.6	13.9	13.8	16.7	NA	14.0	16.2	15.1
06-Sep	NA	13.1	14.6	16.7	13.0	13.3	13.6	13.7	16.6	NA	14.0	16.5	15.0
07-Sep	NA	13.0	14.5	16.4	13.0	13.2	13.4	13.6	16.5	NA	14.1	16.4	14.6
08-Sep	NA	13.0	14.5	16.7	12.9	12.4	13.5	12.9	16.0	NA	13.9	16.3	14.4
09-Sep	NA	13.3	14.3	16.5	12.7	11.9	13.5	13.0	15.3	NA	NA	15.9	14.1
10-Sep	NA	13.3	14.2	15.8	12.3	12.1	13.6	13.6	14.4	NA	NA	15.5	14.5
11-Sep	NA	13.4	14.2	15.3	12.3	11.8	13.6	13.9	13.9	NA	NA	15.6	15.1
12-Sep	NA	13.6	14.3	15.7	12.5	12.0	14.1	14.4	13.7	NA	NA	15.9	15.6
13-Sep	NA	NA	14.3	15.8	12.8	12.5	14.3	14.8	13.2	NA	NA	15.8	15.6
14-Sep	NA	NA	14.2	15.6	13.0	13.1	14.7	15.0	13.1	NA	NA	14.2	15.2
15-Sep	NA	NA	14.0	14.9	13.3	13.4	14.8	14.5	12.7	NA	NA	13.6	14.6
16-Sep	NA	NA	13.9	14.7	13.5	13.7	15.0	14.1	13.0	NA	NA	13.6	14.0
17-Sep	NA	NA	13.7	14.7	13.8	14.2	15.1	NA	12.7	NA	NA	13.1	13.4
18-Sep	NA	NA	13.6	14.6	13.9	14.4	14.7	13.4	12.6	NA	NA	13.3	13.0
19-Sep	NA	NA	13.4	14.3	13.9	14.0	14.1	12.4	12.4	NA	NA	13.3	12.4
20-Sep	NA	NA	13.1	13.9	14.1	13.2	13.8	11.3	12.7	NA	NA	13.1	12.1
21-Sep	NA	NA	12.9	13.8	14.3	12.3	NA	11.0	12.3	NA	NA	12.7	11.5
22-Sep	NA	NA	12.7	13.5	14.4	11.3	NA	10.7	12.2	NA	NA	12.3	11.2
23-Sep	NA	NA	12.6	13.5	14.2	10.6	NA	11.1	12.2	NA	NA	12.8	11.3
24-Sep	NA	NA	12.6	14.0	13.2	10.4	NA	12.1	11.9	NA	NA	13.0	11.3
25-Sep	NA	NA	12.7	14.0	11.9	10.7	NA	12.3	11.7	NA	NA	13.4	11.4
26-Sep	NA	NA	12.8	13.4	11.1	11.0	NA	12.2	11.3	NA	NA	13.8	11.9
27-Sep	NA	NA	12.9	13.5	10.5	11.3	NA	12.2	11.5	NA	NA	13.8	12.1
28-Sep	NA	NA	12.9	13.2	9.6	11.7	NA	12.8	12.4	NA	NA	14.3	11.9
29-Sep	NA	NA	12.9	13.1	9.3	12.2	NA	12.9	12.9	NA	NA	14.4	10.5
30-Sep	NA	NA	12.8	12.8	9.7	12.2	NA	12.0	13.0	NA	NA	14.0	9.6

Table A4. Daily mean temperature data for South Thompson River at Chase (STR60) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	12.4	NA	11.5	12.6	8.8	11.0	12.2	9.7	11.8	11.4	12.7	10.9	12.1
02-Jun	12.9	NA	11.3	12.7	9.5	10.5	11.9	9.2	11.1	11.8	12.5	11.7	12.5
03-Jun	12.9	NA	10.5	12.3	10.2	10.9	11.8	9.0	11.1	12.7	12.4	12.7	12.8
04-Jun	11.6	NA	10.0	12.6	10.6	11.0	11.4	9.4	10.3	13.2	12.6	13.0	12.7
05-Jun	11.9	NA	9.8	12.8	10.7	11.0	10.9	9.8	10.0	13.4	12.5	12.6	12.4
06-Jun	11.1	NA	9.2	13.0	10.5	11.3	10.7	9.7	10.6	13.3	12.5	12.3	11.8
07-Jun	10.5	NA	9.4	13.7	9.6	11.3	10.9	9.2	11.5	13.8	12.1	12.9	10.9
08-Jun	9.9	NA	9.3	13.7	8.9	11.4	11.0	9.2	12.5	14.0	12.0	13.0	10.5
09-Jun	10.7	NA	9.5	13.9	8.5	11.3	11.2	9.4	13.1	14.3	12.3	12.6	10.6
10-Jun	11.5	NA	10.2	14.5	NA	11.2	11.7	9.9	13.6	13.9	12.9	12.1	11.3
11-Jun	12.4	NA	10.3	14.9	NA	11.4	12.0	10.6	13.7	13.6	12.9	12.0	11.9
12-Jun	12.3	NA	11.1	15.1	NA	11.8	12.4	11.5	13.9	13.0	12.6	12.7	11.8
13-Jun	12.6	NA	11.1	14.9	NA	12.1	12.5	12.0	14.1	12.3	12.5	13.1	11.4
14-Jun	12.8	NA	11.2	14.1	NA	12.3	12.0	12.3	14.2	12.2	12.3	13.0	11.3
15-Jun	13.4	11.0	11.6	13.8	NA	12.3	11.9	12.4	14.6	11.8	13.0	12.7	11.0
16-Jun	14.1	11.0	12.2	14.0	NA	12.0	11.6	12.4	14.9	11.3	13.5	12.5	11.7
17-Jun	14.3	10.9	11.3	12.8	NA	10.8	11.6	12.2	14.9	11.9	13.9	13.0	12.3
18-Jun	14.7	10.6	11.5	13.1	NA	11.2	11.3	11.7	14.8	12.9	14.0	13.1	12.4
19-Jun	14.5	10.6	12.1	14.0	NA	11.5	11.4	11.1	14.9	13.7	14.1	13.5	12.5
20-Jun	14.1	10.3	12.3	14.6	NA	11.5	12.3	11.2	15.0	14.1	14.4	13.6	13.3
21-Jun	14.2	9.9	12.3	14.7	NA	11.9	12.8	12.5	14.5	14.6	14.7	13.9	13.8
22-Jun	14.7	10.1	13.1	15.2	NA	12.7	13.1	13.5	13.5	15.0	14.7	14.3	13.8
23-Jun	14.8	11.2	13.2	15.4	NA	13.4	13.4	13.3	12.7	15.3	14.8	14.1	13.0
24-Jun	14.2	12.2	13.3	15.2	NA	13.7	13.4	13.0	12.6	15.9	14.6	14.1	11.9
25-Jun	14.4	12.8	12.9	15.6	NA	13.4	13.0	12.4	13.2	16.5	14.8	14.5	11.1
26-Jun	14.8	13.0	13.5	16.1	NA	13.1	13.0	12.7	13.8	16.5	14.9	15.1	11.1
27-Jun	14.6	13.0	13.0	16.2	NA	13.9	13.3	13.3	14.5	16.6	15.0	15.5	12.1
28-Jun	14.0	13.0	12.2	16.4	NA	14.5	13.9	13.5	14.9	17.1	15.0	15.7	12.9
29-Jun	14.9	13.1	11.8	16.9	NA	15.1	14.5	13.5	15.3	17.1	15.2	15.3	13.2
30-Jun	15.7	12.8	12.2	17.4	NA	15.5	14.7	13.6	15.6	17.1	15.7	14.8	13.2
01-Jul	15.9	13.1	12.9	18.0	NA	15.4	15.0	12.8	15.3	17.4	16.0	14.8	13.9
02-Jul	NA	13.7	13.0	18.1	NA	14.9	NA	12.9	14.1	17.7	16.1	15.8	14.4
03-Jul	NA	14.0	13.2	16.9	NA	13.8	NA	13.4	13.8	17.5	15.9	16.3	14.5
04-Jul	NA	14.0	14.3	17.4	NA	13.4	NA	13.6	14.6	17.1	15.4	16.7	15.2
05-Jul	NA	13.6	14.5	17.8	NA	13.8	NA	13.3	15.1	16.8	15.9	16.9	15.5
06-Jul	NA	12.8	14.9	18.1	NA	14.1	NA	13.3	15.2	17.2	15.9	16.9	15.7
07-Jul	NA	12.6	14.9	18.6	NA	14.3	NA	14.4	16.0	17.1	16.0	16.8	15.7
08-Jul	NA	13.5	15.1	17.8	NA	14.9	NA	14.7	16.1	16.2	15.4	17.1	15.1
09-Jul	NA	14.2	16.1	19.0	NA	15.3	NA	14.6	16.5	16.1	15.2	17.0	15.0
10-Jul	NA	14.4	15.8	19.0	NA	15.3	NA	15.2	16.5	15.7	15.7	17.5	15.0
11-Jul	NA	14.0	15.1	19.0	NA	15.6	NA	15.9	15.9	16.0	16.2	17.6	15.2
12-Jul	NA	13.6	14.7	18.6	NA	16.0	NA	16.6	17.1	16.1	16.7	18.1	16.1
13-Jul	NA	14.3	15.0	18.1	NA	16.0	NA	16.5	16.8	16.4	16.7	18.2	17.2
14-Jul	NA	14.8	15.5	17.5	NA	16.0	NA	16.7	16.5	16.8	17.1	18.4	NA

15-Jul	NA	15.8	15.9	17.7	NA	15.2	NA	16.7	15.6	17.3	17.0	18.2	NA
16-Jul	NA	15.8	16.0	18.2	NA	14.4	NA	17.2	15.4	17.5	16.9	18.1	NA
17-Jul	NA	15.5	15.4	18.2	NA	14.4	NA	17.5	15.6	18.0	17.0	18.3	NA
18-Jul	NA	14.8	15.2	18.8	NA	15.1	NA	17.5	16.0	18.8	17.0	17.8	NA
19-Jul	NA	13.9	15.0	18.8	NA	15.7	NA	17.3	16.2	19.0	17.1	17.7	NA
20-Jul	NA	13.4	15.2	18.6	NA	16.3	NA	16.7	16.8	18.9	17.2	17.7	NA
21-Jul	NA	14.0	15.6	18.9	NA	17.1	NA	16.2	17.7	19.2	17.2	18.5	NA
22-Jul	NA	14.9	15.8	19.0	NA	17.5	NA	16.5	18.6	19.8	17.0	19.0	17.1
23-Jul	NA	15.8	15.8	19.9	NA	17.4	NA	17.1	18.5	20.2	17.0	19.5	17.5
24-Jul	NA	16.4	15.6	19.7	NA	17.4	NA	17.7	18.5	20.8	17.0	20.0	17.9
25-Jul	NA	16.8	15.6	20.8	NA	17.5	NA	18.3	18.8	20.7	16.9	20.3	18.2
26-Jul	NA	16.8	16.3	21.0	NA	18.0	NA	18.5	18.8	20.4	17.4	20.1	18.4
27-Jul	NA	17.3	16.9	22.1	NA	18.2	NA	18.5	19.0	20.0	18.0	NA	18.9
28-Jul	NA	17.8	17.2	22.2	NA	18.0	NA	17.5	19.3	19.8	18.5	20.6	19.1
29-Jul	NA	18.4	17.3	22.3	NA	18.1	NA	16.4	19.6	20.3	18.4	20.0	19.0
30-Jul	NA	18.7	17.5	22.6	NA	18.5	NA	16.2	20.0	20.1	18.8	18.8	18.4
31-Jul	NA	18.4	17.6	22.2	NA	18.6	NA	16.1	20.4	20.5	19.3	18.4	17.9
01-Aug	19.0	18.3	17.5	22.0	NA	18.6	NA	15.9	20.3	20.3	19.1	17.9	17.6
02-Aug	18.7	17.0	16.9	22.2	NA	18.3	NA	14.6	20.0	21.1	19.2	18.5	17.8
03-Aug	19.3	16.9	16.9	22.4	NA	17.5	NA	14.8	20.3	20.6	19.0	18.3	17.4
04-Aug	20.0	16.5	17.2	22.8	NA	17.3	NA	15.1	20.0	20.9	19.1	18.2	17.6
05-Aug	19.0	16.2	17.4	22.6	NA	17.3	NA	15.5	21.0	20.6	19.4	18.2	18.0
06-Aug	18.4	16.1	17.3	21.3	NA	17.8	NA	15.5	20.5	20.3	19.7	18.8	18.6
07-Aug	18.6	15.9	17.5	21.3	NA	18.4	NA	15.7	20.7	20.2	19.7	18.5	19.0
08-Aug	18.2	16.4	16.4	21.6	NA	19.1	NA	16.4	21.0	20.5	19.7	18.6	18.8
09-Aug	18.6	16.9	16.2	21.8	NA	19.3	NA	16.9	20.5	20.7	19.6	18.6	18.5
10-Aug	18.6	17.4	15.7	20.6	NA	19.6	NA	17.2	20.0	21.0	19.1	18.5	18.3
11-Aug	18.2	17.6	16.7	20.8	NA	19.3	NA	17.4	20.1	21.6	19.6	18.1	18.2
12-Aug	17.7	17.4	17.0	21.6	NA	18.6	NA	17.8	19.8	21.6	19.8	18.4	18.2
13-Aug	18.0	17.7	17.6	21.9	NA	17.9	19.0	18.1	20.2	22.0	19.8	18.9	18.5
14-Aug	17.9	18.1	17.9	21.4	NA	17.9	19.3	18.3	20.8	22.2	19.8	18.9	18.7
15-Aug	17.7	17.8	18.1	20.3	NA	17.9	19.6	17.6	20.8	22.1	20.2	18.7	19.2
16-Aug	17.7	18.0	18.0	19.7	NA	18.3	20.1	17.2	20.4	22.2	20.0	18.7	19.4
17-Aug	17.3	17.8	18.3	19.6	NA	18.6	20.1	17.2	20.1	22.2	19.6	18.8	18.9
18-Aug	17.3	17.9	18.7	19.4	NA	18.2	19.5	16.7	20.5	22.2	19.6	19.5	18.5
19-Aug	17.6	17.5	19.1	19.9	NA	18.2	19.2	17.2	19.9	22.6	19.6	19.4	18.0
20-Aug	17.9	17.7	19.5	20.4	NA	18.1	18.8	16.8	19.8	22.7	20.0	19.4	18.1
21-Aug	18.0	17.6	19.9	19.5	NA	18.1	17.9	17.2	20.1	22.5	19.7	19.6	18.4
22-Aug	18.3	17.9	19.6	19.9	NA	18.4	18.1	17.8	20.1	22.1	19.5	19.8	18.3
23-Aug	17.9	18.4	19.5	19.9	NA	18.8	18.3	18.4	19.2	21.6	18.9	19.5	18.4
24-Aug	17.1	18.8	19.3	19.8	NA	19.0	18.3	18.9	19.2	21.3	18.5	19.3	18.6
25-Aug	17.2	19.0	19.3	20.0	NA	18.8	18.3	19.2	19.2	21.0	18.5	19.7	18.4
26-Aug	17.4	19.2	19.3	19.7	NA	18.5	18.5	19.3	19.3	20.6	19.0	19.9	18.0
27-Aug	17.5	19.2	19.4	19.9	NA	18.2	18.9	19.6	18.9	20.2	18.8	20.1	18.2
28-Aug	17.9	19.5	19.3	20.3	NA	17.7	18.8	20.2	19.1	20.0	18.9	19.9	18.0
29-Aug	17.3	19.9	19.2	20.3	NA	17.6	19.0	20.2	19.0	19.9	18.7	19.6	18.4
30-Aug	17.7	19.8	19.3	20.3	NA	17.4	19.6	19.6	19.2	20.0	18.5	18.9	19.0
31-Aug	17.9	18.9	19.3	20.4	NA	17.2	19.1	19.3	19.3	20.1	18.7	18.8	18.8
01-Sep	18.0	18.8	19.5	20.5	NA	17.3	18.8	19.3	18.5	19.8	18.7	18.9	18.6
02-Sep	18.3	18.8	19.6	20.5	NA	17.0	18.5	18.9	18.7	19.2	18.5	18.9	18.7

03-Sep	18.3	18.3	18.6	20.3	NA	16.8	18.1	18.5	19.2	18.9	18.4	19.0	18.5
04-Sep	18.3	17.9	19.1	20.0	NA	16.7	17.4	18.0	19.4	18.7	18.4	18.9	18.5
05-Sep	17.9	17.4	19.0	19.9	NA	16.2	17.6	17.7	19.3	18.5	18.3	18.5	18.5
06-Sep	18.3	17.4	18.6	20.2	NA	16.6	17.4	17.5	19.1	18.2	18.4	18.5	18.6
07-Sep	18.3	17.3	18.7	19.9	NA	16.3	17.3	16.8	18.8	18.3	18.4	18.1	18.3
08-Sep	18.3	17.5	18.8	19.4	NA	15.9	17.1	16.7	18.6	18.1	18.1	18.7	18.1
09-Sep	18.8	17.8	18.7	19.0	NA	15.5	17.0	16.5	18.6	17.9	17.7	18.4	18.0
10-Sep	18.9	17.8	18.9	18.5	NA	15.6	16.8	16.7	18.4	17.8	17.4	18.5	18.1
11-Sep	18.8	17.8	18.4	19.2	NA	15.5	16.8	16.9	18.2	17.7	17.2	18.9	18.4
12-Sep	18.9	17.5	18.1	19.3	NA	15.8	16.8	17.2	18.0	17.6	17.2	19.0	18.1
13-Sep	18.8	NA	18.2	19.1	NA	16.0	16.8	17.2	17.7	17.5	17.2	18.4	17.9
14-Sep	18.8	NA	17.7	18.6	NA	16.0	16.9	17.4	17.6	17.3	17.2	17.8	17.9
15-Sep	18.8	NA	18.0	18.5	NA	16.2	17.0	17.3	17.1	17.1	16.9	17.4	17.9
16-Sep	18.5	NA	17.8	18.6	NA	16.5	17.1	17.2	16.8	16.9	16.9	16.9	17.6
17-Sep	18.2	NA	17.1	18.2	NA	16.6	17.2	NA	16.6	16.7	16.8	16.7	17.3
18-Sep	18.1	NA	17.0	17.9	NA	16.3	17.0	NA	16.3	16.3	16.8	16.5	17.2
19-Sep	17.9	NA	17.2	17.4	NA	16.3	16.6	NA	16.1	16.0	16.9	16.3	17.0
20-Sep	17.5	NA	16.9	17.8	NA	16.4	16.5	NA	16.2	15.7	16.7	15.8	16.7
21-Sep	17.0	NA	16.9	17.8	NA	16.2	NA	NA	16.0	15.6	16.5	15.6	16.4
22-Sep	16.6	NA	16.6	17.7	NA	15.8	NA	NA	16.0	15.5	16.2	15.7	16.2
23-Sep	16.6	NA	16.4	17.6	NA	15.4	NA	NA	16.1	15.4	16.0	15.7	16.0
24-Sep	16.8	NA	16.3	17.4	NA	15.3	NA	NA	15.8	15.3	15.8	15.6	15.9
25-Sep	16.5	NA	16.4	17.0	NA	15.4	NA	NA	15.7	15.3	16.0	15.5	15.7
26-Sep	16.3	NA	16.1	16.9	NA	15.3	NA	NA	15.8	15.2	16.0	15.3	15.6
27-Sep	16.2	NA	15.9	16.9	NA	15.2	NA	15.5	15.8	15.3	15.9	15.4	15.4
28-Sep	16.8	NA	16.0	17.0	NA	15.3	NA	15.5	15.8	15.4	15.4	15.8	15.1
29-Sep	16.5	NA	15.5	16.9	NA	15.3	NA	15.5	15.8	15.2	15.2	15.9	14.7
30-Sep	15.9	NA	15.4	16.7	NA	15.3	NA	15.0	15.8	15.0	15.1	15.7	14.1

Table A5. Daily mean temperature data for Chilcotin River at Alexis Creek (CR50) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	NA	NA	9.2	11.1	10.0	10.3	10.4	9.7	9.9	9.6	10.3	11.2	12.6
02-Jun	NA	NA	8.9	9.9	9.9	10.6	9.5	10.3	9.7	9.7	10.9	11.0	12.7
03-Jun	NA	NA	9.2	10.1	10.0	11.8	10.1	10.6	9.9	11.6	NA	10.1	13.0
04-Jun	NA	NA	9.0	10.4	10.3	11.9	10.5	11.0	10.8	11.3	NA	9.7	12.7
05-Jun	NA	NA	9.5	10.0	10.0	11.0	11.1	10.8	11.6	11.6	NA	9.6	10.8
06-Jun	NA	NA	9.6	10.4	8.9	10.2	10.9	9.2	11.6	10.9	NA	10.4	9.4
07-Jun	NA	NA	9.5	10.5	8.3	10.7	11.3	8.6	11.4	10.6	NA	11.1	9.5
08-Jun	NA	NA	9.8	10.6	8.3	11.4	11.1	9.0	12.7	11.4	NA	11.4	10.1
09-Jun	NA	NA	10.7	11.0	9.0	10.6	10.5	10.8	12.9	12.0	NA	11.4	10.4
10-Jun	NA	NA	11.4	11.8	9.7	10.2	10.5	11.6	11.7	12.5	NA	10.5	10.0
11-Jun	NA	NA	11.7	12.1	10.5	10.2	10.0	11.6	10.6	12.0	NA	10.5	9.5
12-Jun	NA	NA	11.6	11.4	11.6	10.7	10.1	12.4	11.6	11.4	NA	9.5	9.8
13-Jun	NA	NA	11.6	11.3	12.3	10.1	11.4	13.1	11.1	11.8	NA	9.4	9.9
14-Jun	NA	9.6	11.6	10.5	12.3	10.7	11.5	13.3	10.9	11.3	NA	9.9	10.2
15-Jun	NA	9.2	11.6	10.5	12.7	10.9	10.9	12.5	10.8	10.9	NA	10.9	10.4
16-Jun	NA	10.0	10.8	10.9	12.8	11.2	10.7	12.6	11.6	10.8	NA	10.9	10.2
17-Jun	NA	9.6	10.6	11.2	11.7	12.4	10.7	12.1	11.8	10.8	NA	10.5	10.4
18-Jun	NA	10.2	10.4	11.4	11.1	12.2	11.6	11.3	12.1	10.8	NA	10.2	9.9
19-Jun	NA	10.6	10.2	11.9	11.1	11.3	12.4	11.1	11.6	10.9	NA	10.4	10.6
20-Jun	NA	10.4	10.0	12.3	10.6	12.0	13.1	11.8	11.5	12.4	NA	10.7	10.9
21-Jun	NA	10.9	10.4	13.1	9.9	11.6	12.5	12.6	10.9	12.6	NA	10.5	11.0
22-Jun	NA	11.3	9.8	13.5	9.6	12.3	13.1	13.0	10.8	12.6	NA	11.0	10.3
23-Jun	NA	10.6	10.0	13.5	10.1	11.8	12.4	12.6	11.2	11.9	NA	11.9	10.1
24-Jun	NA	10.1	11.0	13.2	10.5	12.0	11.3	11.9	11.8	12.3	NA	12.5	10.0
25-Jun	NA	10.6	10.8	13.2	10.2	12.5	11.1	11.7	12.8	12.0	NA	13.3	10.2
26-Jun	NA	11.3	11.1	13.1	10.1	13.0	11.7	12.7	12.6	12.4	NA	14.1	10.5
27-Jun	NA	10.7	10.6	13.4	9.8	13.4	12.4	12.5	12.7	12.2	NA	14.3	11.0
28-Jun	NA	10.8	10.9	13.7	10.4	14.3	12.3	11.8	13.5	12.2	NA	13.5	12.1
29-Jun	NA	11.3	11.6	13.7	10.3	13.9	12.6	11.4	13.4	13.2	NA	12.8	11.9
30-Jun	NA	11.5	11.5	13.4	10.7	12.7	12.4	11.2	13.5	13.4	NA	13.7	11.5
01-Jul	NA	11.4	11.5	13.6	11.2	11.9	12.8	10.9	12.2	15.8	13.1	14.9	11.4
02-Jul	NA	11.4	11.9	13.9	10.0	10.8	13.1	11.0	12.0	15.3	12.9	15.3	11.5
03-Jul	NA	11.3	12.3	13.4	9.9	10.7	13.9	11.2	12.6	15.0	12.3	15.7	12.0
04-Jul	NA	10.9	13.2	13.4	10.1	11.6	14.5	10.7	12.9	14.2	12.3	15.2	12.0
05-Jul	NA	11.5	13.3	14.6	10.5	11.9	13.9	11.3	13.0	14.3	12.5	15.0	12.4
06-Jul	NA	12.6	12.6	15.0	11.2	11.9	13.0	12.2	13.2	14.7	12.8	15.0	12.6
07-Jul	NA	13.6	12.2	15.2	11.1	12.5	13.4	12.6	13.3	13.6	12.5	14.3	12.2
08-Jul	NA	13.7	12.2	15.0	11.0	12.9	13.5	12.6	13.7	13.4	12.7	14.4	12.6
09-Jul	NA	12.8	12.1	15.3	11.9	12.6	14.2	13.2	13.6	13.8	12.2	14.7	13.0
10-Jul	NA	12.6	11.4	16.1	12.5	12.7	14.4	13.9	14.1	13.9	12.2	14.6	13.1
11-Jul	NA	13.0	12.2	15.8	12.5	13.3	14.6	14.6	14.9	14.6	12.4	14.0	12.8
12-Jul	NA	13.2	12.6	15.1	12.8	13.4	13.9	14.1	15.1	15.0	13.1	13.6	13.3
13-Jul	NA	13.4	12.8	14.1	12.2	13.1	14.2	14.0	14.2	15.3	13.7	13.5	14.5
14-Jul	NA	13.7	13.4	13.8	10.9	12.6	14.4	14.1	13.9	15.6	13.5	13.1	14.4

15-Jul	NA	13.6	12.9	14.2	9.3	12.7	13.6	12.9	13.6	15.8	13.7	13.4	14.6
16-Jul	NA	11.9	13.1	14.4	9.3	13.5	12.5	13.3	13.4	16.3	13.7	13.4	13.7
17-Jul	NA	12.4	13.0	15.3	10.1	14.0	12.1	13.7	13.6	16.2	14.0	13.6	13.6
18-Jul	NA	12.7	13.4	15.3	10.7	14.8	12.7	13.4	14.1	16.5	14.5	13.9	13.2
19-Jul	NA	12.9	13.9	15.6	11.5	15.5	13.3	13.5	13.8	16.4	14.7	13.5	13.4
20-Jul	NA	13.5	14.3	15.2	11.7	15.7	13.1	13.5	14.7	15.3	13.7	14.7	13.2
21-Jul	NA	14.3	14.3	15.1	12.0	15.7	13.6	13.5	14.8	15.8	13.9	16.3	12.6
22-Jul	NA	14.8	13.5	15.0	12.2	16.2	14.2	13.4	15.0	15.8	14.7	17.1	12.8
23-Jul	NA	14.9	13.1	15.9	11.9	16.2	14.3	13.6	15.1	15.6	14.5	17.0	13.3
24-Jul	NA	13.8	12.5	16.5	12.2	15.7	14.3	14.6	14.7	16.7	14.2	16.1	12.9
25-Jul	NA	13.1	12.4	16.6	12.1	15.6	13.6	16.2	14.0	17.1	14.6	14.7	13.3
26-Jul	NA	13.2	13.1	16.6	12.4	15.2	13.9	15.9	14.8	15.8	14.9	15.6	14.2
27-Jul	NA	14.7	13.7	16.1	12.8	14.3	14.5	14.2	15.8	14.9	15.5	16.7	14.3
28-Jul	NA	15.9	14.5	17.5	13.4	14.1	14.1	14.2	16.0	14.1	16.1	15.9	14.1
29-Jul	NA	15.7	14.5	17.4	13.3	14.2	13.7	13.9	15.4	14.5	16.1	15.5	13.9
30-Jul	NA	14.9	14.5	17.9	12.7	14.7	14.1	13.8	15.2	15.6	15.4	15.7	13.2
31-Jul	NA	14.5	13.8	17.4	11.9	15.2	14.1	13.2	16.6	16.0	15.0	15.0	13.4
01-Aug	NA	14.2	13.3	17.5	11.4	14.8	14.2	12.6	16.8	16.2	15.0	14.9	13.8
02-Aug	NA	13.9	13.9	16.1	11.6	14.6	13.9	11.8	15.1	16.9	14.4	14.5	14.2
03-Aug	NA	14.0	14.5	16.9	13.0	14.6	14.2	11.6	15.2	17.4	14.5	14.4	14.4
04-Aug	NA	13.3	14.9	16.9	13.9	14.6	14.0	10.7	15.3	16.5	15.2	15.5	14.3
05-Aug	NA	13.9	15.2	16.8	13.8	15.8	13.2	9.8	15.6	15.9	15.8	14.9	14.5
06-Aug	NA	14.3	14.8	16.0	13.8	16.1	12.9	10.8	15.3	15.4	15.9	15.2	15.1
07-Aug	NA	14.7	14.8	16.4	13.6	15.6	13.8	12.0	15.3	15.6	16.1	15.4	15.8
08-Aug	NA	14.7	13.9	16.2	14.5	15.5	13.7	13.3	15.3	15.8	15.6	14.7	14.7
09-Aug	NA	15.1	13.0	15.7	14.6	15.4	14.0	13.9	15.2	15.8	14.5	14.2	13.8
10-Aug	NA	14.8	13.0	16.0	14.5	15.1	14.0	13.5	15.4	15.5	14.3	14.8	13.2
11-Aug	NA	14.2	13.2	15.6	14.1	15.7	14.6	13.0	15.4	15.9	13.0	14.7	13.4
12-Aug	NA	14.7	14.8	16.4	14.4	15.2	15.6	13.6	14.6	16.4	13.6	14.5	13.7
13-Aug	NA	14.9	15.7	16.6	14.0	14.7	15.7	14.1	14.5	16.5	13.3	14.9	13.6
14-Aug	NA	14.8	15.1	16.7	13.6	14.2	15.8	14.0	15.2	17.1	13.5	15.6	13.6
15-Aug	NA	14.3	13.7	15.8	13.7	14.3	16.0	13.7	15.7	17.8	14.7	15.4	13.9
16-Aug	NA	13.7	11.4	14.3	13.4	14.6	16.4	13.0	15.7	17.5	14.6	15.0	14.5
17-Aug	NA	13.1	11.2	14.1	14.1	14.4	16.3	12.4	15.5	17.8	14.7	15.1	14.2
18-Aug	NA	13.4	11.8	14.6	14.3	14.3	15.3	12.7	15.6	17.8	13.9	15.9	13.8
19-Aug	NA	13.0	12.8	14.9	14.2	14.0	14.5	13.2	15.1	17.9	14.2	15.8	13.8
20-Aug	NA	12.5	13.9	15.4	14.4	12.8	14.4	13.2	14.3	17.9	14.7	15.6	13.8
21-Aug	NA	13.8	15.3	15.6	14.7	13.5	14.4	13.7	14.9	17.3	14.6	15.7	13.9
22-Aug	NA	14.6	14.4	15.6	14.2	14.2	13.6	14.6	14.4	16.4	13.7	15.6	14.3
23-Aug	NA	14.5	13.8	15.4	14.6	14.8	13.3	15.4	14.0	14.7	13.9	15.8	14.4
24-Aug	NA	14.7	13.3	15.4	14.8	15.4	12.8	15.8	12.8	12.9	13.2	15.6	14.4
25-Aug	NA	14.9	13.2	15.1	14.3	14.8	12.8	16.0	13.4	12.9	13.7	14.7	14.6
26-Aug	NA	15.6	13.4	14.9	13.9	13.4	13.1	15.8	14.2	14.1	14.3	15.1	14.1
27-Aug	NA	15.2	13.5	14.7	13.8	12.6	13.5	15.6	14.4	14.5	14.3	15.7	13.4
28-Aug	NA	15.0	12.9	14.8	14.4	12.0	14.3	16.0	14.2	14.4	14.6	16.1	13.1
29-Aug	NA	15.0	12.7	15.3	13.7	13.3	14.4	16.2	13.9	14.1	13.8	14.7	14.1
30-Aug	NA	13.6	12.9	15.2	12.2	13.4	14.3	14.6	14.4	14.4	13.4	13.9	13.7
31-Aug	NA	13.2	13.4	15.5	11.7	13.3	14.2	13.6	14.3	14.4	12.8	13.3	13.7
01-Sep	NA	13.1	13.6	15.8	11.9	11.7	13.3	13.7	13.7	13.4	12.8	14.0	13.0
02-Sep	NA	13.1	14.2	15.5	12.1	11.1	12.6	14.2	14.2	13.2	12.9	14.7	12.6

03-Sep	NA	12.5	13.2	14.8	12.4	10.4	12.7	13.0	14.7	13.1	13.0	14.7	12.0
04-Sep	NA	12.1	13.0	14.7	13.1	10.7	11.9	12.4	14.8	13.5	12.7	14.8	10.0
05-Sep	NA	11.7	13.0	14.4	12.8	11.3	11.7	12.0	14.8	12.9	12.3	14.9	11.7
06-Sep	NA	11.7	12.4	15.0	12.1	11.6	12.7	11.6	14.2	13.0	12.5	14.7	12.2
07-Sep	NA	12.0	12.9	14.6	11.2	12.1	11.8	10.0	14.2	13.0	13.5	14.4	12.1
08-Sep	NA	12.7	12.8	13.6	12.0	11.4	11.9	10.1	13.1	13.5	14.1	14.3	13.0
09-Sep	NA	12.3	13.5	13.1	12.6	10.6	11.2	10.6	13.0	13.1	NA	14.4	12.9
10-Sep	NA	12.7	13.4	12.9	12.3	10.4	11.4	11.8	13.0	12.4	NA	13.8	12.3
11-Sep	NA	12.9	13.8	13.5	11.2	9.4	10.3	12.1	NA	11.8	NA	14.0	11.7
12-Sep	NA	NA	12.9	13.6	11.3	9.1	11.1	NA	NA	11.6	NA	13.9	11.2
13-Sep	NA	NA	12.0	13.7	11.6	9.9	NA	NA	NA	10.9	NA	13.4	12.2
14-Sep	NA	NA	12.2	13.1	11.9	10.0	NA	NA	NA	11.1	NA	12.0	12.0
15-Sep	NA	NA	12.3	12.3	12.2	11.3	NA	NA	NA	11.5	NA	9.1	12.0
16-Sep	NA	NA	11.6	12.2	12.4	11.7	NA	NA	NA	11.0	NA	8.5	10.8
17-Sep	NA	NA	10.8	12.6	12.1	13.0	NA	NA	NA	NA	NA	7.9	13.0
18-Sep	NA	NA	10.0	12.6	12.3	13.0	NA	NA	NA	NA	NA	9.3	13.0
19-Sep	NA	NA	10.2	12.4	12.7	12.0	NA	NA	NA	NA	NA	10.0	13.2
20-Sep	NA	NA	11.1	12.1	12.9	11.2	NA	NA	NA	NA	NA	10.6	13.1
21-Sep	NA	NA	11.6	11.8	12.6	9.3	NA	NA	NA	NA	NA	10.1	13.0
22-Sep	NA	NA	11.8	11.8	12.7	8.0	NA	NA	NA	NA	NA	9.3	13.2
23-Sep	NA	NA	11.8	11.8	12.2	7.2	NA	NA	NA	NA	NA	10.5	13.1
24-Sep	NA	NA	11.5	12.6	10.0	8.9	NA	NA	NA	NA	NA	11.0	12.5
25-Sep	NA	NA	11.5	12.2	9.7	10.0	NA	NA	NA	NA	NA	11.9	NA
26-Sep	NA	NA	11.8	10.7	9.2	10.1	NA	NA	NA	NA	NA	12.0	NA
27-Sep	NA	NA	10.4	11.6	9.3	10.0	NA	NA	NA	NA	NA	11.2	NA
28-Sep	NA	NA	10.1	10.8	9.5	10.0	NA	NA	NA	NA	NA	11.6	NA
29-Sep	NA	NA	9.5	10.2	9.7	10.2	NA	NA	NA	NA	NA	11.3	NA
30-Sep	NA	NA	9.8	10.6	9.3	10.2	NA	NA	NA	NA	NA	10.2	NA

Table A6. Daily mean temperature data for Quesnel River at Quesnel (QR1) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	10.2	NA	NA	11.9	8.0	9.7	9.6	8.3	10.8	10.0	11.8	12.2	10.3
02-Jun	10.1	NA	NA	10.1	7.8	10.4	9.4	8.3	10.8	10.2	11.9	12.6	10.6
03-Jun	10.3	NA	NA	10.1	7.9	10.3	9.6	8.3	10.0	10.9	10.6	12.3	11.2
04-Jun	9.9	NA	NA	9.7	8.0	10.2	9.5	8.0	10.1	11.8	11.0	12.1	11.8
05-Jun	10.3	NA	NA	9.9	8.0	10.5	9.4	8.3	10.5	12.4	11.8	11.8	12.7
06-Jun	10.9	NA	NA	11.6	7.9	11.3	9.6	8.5	10.6	12.5	11.3	11.5	12.1
07-Jun	9.5	NA	NA	12.2	8.0	11.6	9.7	8.4	10.7	12.5	11.9	11.8	11.1
08-Jun	9.8	NA	NA	14.4	8.0	11.8	9.7	8.4	11.4	11.9	11.7	12.5	10.9
09-Jun	9.9	NA	NA	14.9	8.1	11.8	9.7	8.3	10.6	12.3	11.4	13.0	10.5
10-Jun	10.3	NA	NA	15.1	8.1	11.5	9.5	8.1	10.2	12.7	11.3	13.6	11.6
11-Jun	11.5	NA	NA	14.7	8.1	11.7	9.4	8.2	10.5	12.9	11.6	13.5	11.4
12-Jun	11.3	NA	NA	12.2	8.0	11.5	9.3	8.9	10.7	12.3	11.1	13.5	10.8
13-Jun	12.1	NA	NA	11.2	8.8	11.4	9.2	9.0	11.4	13.1	10.9	14.6	10.9
14-Jun	12.5	NA	NA	10.6	9.2	11.2	9.2	9.1	12.4	13.0	11.8	14.5	11.3
15-Jun	13.0	9.9	NA	10.0	9.7	11.0	9.0	9.4	12.4	12.8	12.4	14.3	11.7
16-Jun	13.2	9.8	NA	10.3	10.2	10.8	8.8	9.5	13.0	13.2	12.1	12.4	12.0
17-Jun	13.4	9.8	NA	10.1	10.4	10.6	8.7	9.2	13.4	12.9	12.6	12.7	11.5
18-Jun	13.6	9.7	NA	10.3	10.5	10.4	8.6	9.1	13.6	12.7	12.9	12.5	11.1
19-Jun	13.7	9.5	NA	13.0	10.5	10.3	9.0	9.4	13.9	13.6	13.6	12.7	10.2
20-Jun	13.8	9.3	NA	13.1	10.4	10.1	9.5	9.5	12.0	14.9	14.3	13.6	10.9
21-Jun	13.6	9.2	NA	14.1	10.3	9.9	9.5	9.7	11.0	15.0	14.3	12.6	12.2
22-Jun	12.4	9.2	NA	15.0	10.5	9.7	10.2	10.0	13.3	15.0	13.6	11.8	12.2
23-Jun	12.9	9.2	NA	15.3	10.7	9.6	10.1	10.0	10.6	14.6	12.7	11.3	11.8
24-Jun	13.4	9.2	NA	15.1	10.7	9.5	9.8	9.9	11.1	15.2	12.3	13.3	12.0
25-Jun	12.7	9.2	NA	15.9	10.7	9.4	9.8	9.7	12.2	15.1	13.8	14.3	12.6
26-Jun	11.5	9.2	NA	16.6	10.7	9.3	11.0	9.6	11.9	15.9	14.3	15.2	13.1
27-Jun	10.7	9.5	NA	16.8	10.5	9.4	11.8	10.1	12.7	15.5	14.6	15.2	14.0
28-Jun	11.1	9.9	NA	16.0	10.3	9.4	13.6	10.3	13.7	14.7	15.1	14.8	14.0
29-Jun	11.5	10.0	NA	14.1	10.1	9.6	14.0	10.5	14.1	15.5	14.0	12.8	14.2
30-Jun	14.0	10.4	NA	14.7	10.6	9.8	13.6	10.5	15.3	17.0	13.7	11.7	14.3
01-Jul	15.9	10.9	NA	16.9	10.8	10.1	13.4	10.6	15.2	16.7	15.0	12.1	14.2
02-Jul	16.1	11.1	NA	17.4	10.9	10.3	12.8	10.6	14.4	15.0	15.4	13.5	14.2
03-Jul	14.2	11.1	NA	17.6	10.8	10.4	12.5	10.5	14.9	15.6	15.3	15.4	14.6
04-Jul	13.2	11.4	NA	17.3	11.1	10.6	13.5	10.4	15.0	16.8	15.2	17.5	15.5
05-Jul	12.6	11.5	NA	17.3	11.3	10.7	12.9	10.2	15.0	15.8	15.9	18.1	15.8
06-Jul	13.0	11.1	NA	17.5	11.0	10.8	11.3	10.2	13.3	15.3	16.0	18.9	15.7
07-Jul	15.4	11.0	NA	18.0	10.7	10.7	12.1	10.2	13.4	14.2	15.8	18.4	14.2
08-Jul	16.4	11.2	NA	17.6	10.7	10.7	13.4	10.2	14.2	11.8	15.5	18.1	13.1
09-Jul	16.7	11.3	NA	17.0	11.2	10.7	14.8	10.2	15.0	12.1	15.5	18.3	13.3
10-Jul	16.6	11.3	NA	17.1	11.6	10.7	15.0	10.4	14.5	12.4	15.5	18.5	11.8
11-Jul	16.9	11.0	NA	18.1	12.1	10.6	15.1	10.7	15.6	13.1	15.6	17.7	11.9
12-Jul	16.9	11.1	NA	17.8	12.2	10.6	13.6	11.2	16.7	15.6	15.7	16.8	12.5
13-Jul	15.9	11.2	NA	16.4	12.2	10.6	14.4	11.6	17.3	16.7	15.7	17.0	14.2
14-Jul	15.6	11.1	NA	16.1	12.0	10.7	15.2	11.8	17.1	17.2	15.6	17.6	15.6
15-Jul	15.5	10.9	NA	17.1	11.2	10.7	14.8	12.1	17.3	17.6	15.1	17.7	17.4
16-Jul	14.8	10.9	NA	17.7	10.6	10.7	14.9	12.2	17.7	17.7	14.5	17.7	17.9

17-Jul	13.8	10.8	NA	18.1	10.7	10.6	15.2	12.2	17.5	17.6	13.3	17.4	17.3
18-Jul	13.4	10.7	NA	18.4	11.3	10.5	15.3	12.3	17.0	17.9	14.1	17.0	17.3
19-Jul	13.4	11.2	NA	18.2	11.4	10.5	14.4	12.3	16.3	18.1	12.3	16.2	16.6
20-Jul	15.7	12.0	NA	17.9	11.6	10.5	13.7	12.3	16.7	17.2	12.0	16.6	17.6
21-Jul	17.1	11.8	NA	16.9	12.3	10.7	13.9	12.4	18.4	18.3	12.0	18.7	17.6
22-Jul	15.5	11.9	NA	16.1	12.4	10.8	14.2	12.4	19.0	18.1	12.6	19.2	17.6
23-Jul	16.4	12.1	NA	17.0	12.3	11.1	14.4	12.2	18.5	18.3	14.3	19.6	17.5
24-Jul	16.4	12.2	NA	18.9	12.1	11.8	14.4	12.1	15.9	19.6	14.5	18.8	17.3
25-Jul	15.8	12.4	NA	19.0	11.9	11.7	14.2	12.1	13.4	19.3	13.7	17.2	17.3
26-Jul	16.4	12.5	NA	18.8	12.0	11.8	13.9	12.5	14.1	18.2	13.0	16.6	17.0
27-Jul	16.7	12.7	NA	18.3	12.4	12.3	13.7	12.7	15.3	16.8	14.5	16.4	17.7
28-Jul	16.6	13.1	NA	18.8	12.7	13.1	13.7	12.5	16.0	15.6	16.1	15.8	18.1
29-Jul	16.2	14.0	NA	19.1	12.9	13.1	13.9	12.3	16.1	15.7	16.4	15.7	17.9
30-Jul	15.8	15.6	NA	19.5	13.3	12.8	14.0	11.9	16.9	16.6	16.1	16.0	17.3
31-Jul	15.7	15.8	NA	20.6	13.3	13.0	13.5	11.4	17.9	16.7	16.6	16.5	13.7
01-Aug	16.0	14.9	NA	20.6	13.2	14.4	14.5	11.0	18.3	16.0	17.2	17.2	13.8
02-Aug	15.8	15.1	NA	19.5	12.8	13.8	15.4	10.6	18.6	15.7	16.9	17.1	15.1
03-Aug	16.2	14.3	NA	18.8	12.6	13.6	16.2	10.3	17.7	17.0	16.7	16.8	15.5
04-Aug	16.5	14.0	NA	19.0	12.6	13.3	15.9	10.5	16.9	17.7	16.6	17.1	15.4
05-Aug	16.5	13.0	NA	20.1	12.9	14.2	15.5	10.9	16.3	17.4	17.2	15.9	15.8
06-Aug	15.6	12.3	NA	19.8	13.2	15.5	15.5	11.3	16.4	17.7	17.5	16.1	16.0
07-Aug	15.4	11.5	NA	18.5	13.8	15.3	15.6	12.1	17.6	17.9	17.2	16.9	16.8
08-Aug	15.3	12.2	NA	17.8	14.4	15.6	15.6	13.0	18.2	18.0	15.5	17.2	17.1
09-Aug	15.1	14.0	NA	18.4	15.6	16.5	15.5	13.8	18.7	18.5	14.9	17.3	15.6
10-Aug	15.8	15.4	NA	19.6	16.1	15.3	15.6	14.6	18.5	18.2	15.1	17.0	13.9
11-Aug	16.0	16.0	NA	19.4	14.8	14.9	16.2	15.1	18.3	19.0	14.3	16.6	12.7
12-Aug	15.8	16.3	NA	19.8	14.5	14.2	16.7	14.7	18.2	19.1	14.9	15.3	13.9
13-Aug	15.8	16.5	NA	19.7	15.6	13.4	16.9	13.9	18.4	19.2	14.8	14.8	15.1
14-Aug	15.5	16.1	NA	19.5	15.5	12.9	17.0	13.4	19.0	19.5	15.7	15.6	15.9
15-Aug	15.2	15.8	NA	18.6	16.5	13.4	17.1	13.9	19.2	19.7	17.3	16.5	16.5
16-Aug	15.2	15.5	NA	17.9	17.6	15.7	17.1	13.4	19.4	19.8	17.2	16.5	16.8
17-Aug	15.0	14.9	NA	17.2	18.1	16.3	17.5	12.0	19.3	20.1	16.3	16.7	16.9
18-Aug	14.7	14.7	NA	17.1	18.5	16.4	16.6	10.9	19.1	20.2	15.1	17.2	16.9
19-Aug	14.9	15.0	NA	18.0	18.6	16.4	15.8	11.1	18.4	19.8	13.5	16.9	16.8
20-Aug	15.2	15.2	NA	18.4	19.0	16.2	15.3	12.2	17.0	19.2	14.2	16.5	16.3
21-Aug	15.5	15.4	NA	19.0	18.8	NA	15.1	13.8	16.0	18.7	15.9	16.1	16.5
22-Aug	15.3	15.9	NA	18.8	17.9	NA	15.7	15.2	16.1	18.0	15.6	17.2	16.7
23-Aug	14.8	16.6	NA	18.2	18.3	NA	16.2	16.6	16.6	17.1	15.7	17.5	16.4
24-Aug	14.7	16.7	NA	17.9	18.5	NA	15.8	17.8	16.5	17.0	15.9	16.4	16.8
25-Aug	14.8	17.0	NA	17.5	17.6	NA	16.0	18.1	16.7	17.3	15.3	15.9	17.2
26-Aug	14.9	17.0	NA	17.4	17.7	NA	16.1	18.0	17.2	17.7	15.1	16.2	16.5
27-Aug	14.9	16.7	NA	17.6	18.0	NA	16.2	16.7	17.2	17.4	16.2	16.5	15.9
28-Aug	15.2	16.7	NA	17.7	18.1	NA	16.4	17.1	17.3	17.6	17.1	16.7	15.4
29-Aug	15.2	17.3	NA	18.3	17.2	NA	16.0	17.7	17.7	17.3	16.6	16.6	16.0
30-Aug	15.3	16.8	NA	18.2	16.5	NA	15.7	16.7	17.7	17.2	16.2	16.0	16.3
31-Aug	15.2	16.6	NA	17.6	15.3	NA	16.0	15.9	17.7	17.2	15.9	15.9	16.3
01-Sep	15.6	16.6	NA	17.6	11.6	NA	16.1	15.8	17.0	16.3	15.9	15.1	16.1
02-Sep	15.8	16.3	NA	17.6	12.5	NA	15.9	15.9	16.6	15.7	16.2	15.9	16.1
03-Sep	16.0	15.5	NA	17.5	14.2	NA	16.0	15.4	16.3	15.5	16.0	16.6	15.9
04-Sep	16.2	15.5	NA	17.0	15.0	NA	15.3	14.9	17.3	13.8	15.5	17.3	16.1

Table A7. Daily mean temperature data for Horsefly River at Horsefly (HOR22) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	NA	NA	NA	11.8	8.4	9.8	10.1	8.8	10.6	NA	9.9	12.0	11.4
02-Jun	NA	NA	NA	10.7	8.6	10.2	8.2	9.0	10.2	NA	10.2	11.9	11.9
03-Jun	NA	NA	NA	11.6	9.9	10.8	8.3	9.3	9.8	NA	10.9	10.9	12.4
04-Jun	NA	NA	NA	12.0	9.9	11.6	9.3	9.3	10.3	13.8	11.3	11.1	12.6
05-Jun	NA	NA	NA	13.0	8.9	11.2	9.7	9.4	11.5	13.0	11.8	11.4	11.7
06-Jun	NA	NA	NA	13.5	7.9	9.9	9.7	8.5	11.9	10.6	11.5	11.2	11.4
07-Jun	NA	NA	NA	13.3	7.9	10.1	9.7	8.6	12.1	10.8	11.1	11.5	10.5
08-Jun	NA	NA	NA	14.4	8.3	10.3	10.2	9.0	13.2	12.1	12.2	11.8	10.4
09-Jun	NA	NA	NA	15.1	9.1	9.9	10.1	10.2	12.5	12.2	12.7	11.5	10.9
10-Jun	NA	NA	NA	14.8	9.2	10.2	8.9	11.1	11.2	12.0	12.9	11.4	10.6
11-Jun	NA	NA	NA	14.9	10.0	10.1	8.9	11.3	12.0	11.9	12.6	12.6	10.7
12-Jun	NA	NA	NA	14.6	11.0	10.1	10.1	11.5	12.5	11.7	12.1	13.1	10.7
13-Jun	NA	NA	NA	14.0	11.6	10.2	11.1	11.7	12.2	11.7	11.7	13.5	11.0
14-Jun	NA	NA	NA	13.1	11.2	10.2	11.2	12.2	12.2	11.2	11.6	13.2	11.1
15-Jun	NA	10.4	NA	12.0	12.6	9.5	10.4	12.7	12.1	10.8	11.5	12.4	11.5
16-Jun	NA	10.0	NA	12.1	13.0	9.8	9.8	11.7	13.0	11.7	11.2	12.0	11.7
17-Jun	NA	10.1	NA	12.5	12.1	10.5	9.9	11.4	14.0	12.9	11.8	12.2	11.8
18-Jun	NA	9.4	NA	13.6	11.9	10.4	10.9	10.4	14.0	13.2	12.3	12.1	11.9
19-Jun	NA	9.5	NA	14.4	11.6	10.1	12.1	9.9	13.7	13.7	13.1	11.7	11.3
20-Jun	NA	10.3	NA	15.3	10.8	10.2	12.3	10.5	13.1	14.7	14.5	12.4	11.5
21-Jun	NA	10.9	NA	15.7	10.4	10.4	12.7	12.3	11.5	15.0	14.8	12.7	12.6
22-Jun	NA	11.0	NA	16.0	10.5	11.0	12.5	13.0	11.9	14.9	14.2	12.4	12.4
23-Jun	NA	10.9	NA	14.7	10.3	11.0	11.9	12.7	12.8	15.3	12.7	13.2	11.7
24-Jun	NA	11.0	NA	13.1	10.5	11.1	11.2	12.6	13.7	15.5	12.4	14.6	11.5
25-Jun	NA	10.5	NA	13.3	10.6	12.0	10.9	12.8	14.3	15.0	13.1	15.6	11.4
26-Jun	NA	10.8	NA	14.3	11.1	12.3	11.2	12.6	14.4	15.6	13.1	16.6	11.7
27-Jun	NA	11.3	NA	15.0	11.0	12.6	12.0	13.2	14.2	14.8	12.6	17.0	13.3
28-Jun	NA	10.8	NA	14.6	10.5	13.3	12.0	12.4	14.9	13.6	13.9	16.7	13.6
29-Jun	NA	10.4	NA	15.0	10.6	13.1	11.9	11.9	15.8	13.9	14.8	15.8	13.5
30-Jun	NA	11.0	NA	15.7	10.9	12.7	12.4	11.6	15.6	15.9	15.1	15.6	13.2
01-Jul	NA	12.0	NA	16.4	11.2	12.2	13.1	11.6	14.2	16.7	14.6	16.6	12.5
02-Jul	NA	11.5	NA	16.8	11.1	10.8	13.4	11.4	12.5	15.2	13.7	17.6	13.6
03-Jul	NA	11.2	NA	16.9	11.1	10.4	13.9	11.5	13.5	14.2	13.5	18.6	14.8
04-Jul	NA	11.3	NA	16.8	11.7	10.9	14.9	11.7	13.9	14.6	13.6	18.9	15.3
05-Jul	NA	10.4	NA	16.2	11.8	11.8	14.7	11.2	14.0	15.5	13.8	19.0	16.4
06-Jul	NA	10.8	NA	16.9	11.8	12.2	13.3	11.5	14.1	15.9	13.7	18.6	16.5
07-Jul	NA	12.5	NA	17.6	11.9	13.0	13.2	12.7	15.1	14.5	13.1	17.4	15.6
08-Jul	16.1	13.0	NA	17.7	11.3	12.7	14.6	12.6	15.0	14.2	13.0	17.0	15.0
09-Jul	16.1	11.9	NA	18.2	10.9	11.7	15.8	12.9	15.6	14.6	12.7	17.7	15.5
10-Jul	15.4	12.0	NA	18.5	12.4	12.3	16.4	14.3	16.7	14.9	13.1	17.4	16.6
11-Jul	15.1	13.1	NA	17.8	13.7	13.0	16.2	15.4	17.8	14.9	13.3	15.2	17.4
12-Jul	15.4	13.9	NA	15.5	13.8	13.5	15.9	15.7	18.6	15.9	13.7	14.6	17.9
13-Jul	15.6	13.9	NA	14.8	13.4	14.3	16.2	14.8	17.9	17.0	14.3	14.9	18.6
14-Jul	15.9	14.1	NA	15.2	12.4	13.7	16.1	13.9	17.1	17.3	13.9	15.0	19.2
15-Jul	16.4	13.8	NA	15.8	11.4	13.3	14.9	14.3	16.6	18.2	13.8	15.4	19.5

16-Jul	16.7	12.6	NA	16.8	11.8	13.5	14.4	14.9	16.7	18.7	13.5	15.6	19.0
17-Jul	17.3	12.3	NA	17.8	12.9	14.5	14.0	15.3	16.9	19.5	13.9	16.1	17.9
18-Jul	18.0	12.1	NA	17.9	13.4	15.5	12.9	16.0	17.2	20.4	15.1	16.3	17.3
19-Jul	18.3	12.0	NA	17.5	14.2	15.8	11.2	15.1	17.0	20.4	15.1	15.8	16.3
20-Jul	18.4	11.4	NA	17.5	14.9	15.8	11.6	14.6	18.1	19.0	15.0	16.7	15.3
21-Jul	18.5	12.5	NA	18.3	15.3	16.2	13.1	14.7	19.4	18.3	15.5	18.9	14.8
22-Jul	18.7	13.7	NA	19.7	15.1	16.2	14.6	15.9	20.3	18.3	15.7	20.9	15.5
23-Jul	18.5	14.5	NA	20.5	13.8	16.0	15.2	17.2	20.2	19.4	15.9	21.9	15.7
24-Jul	17.1	15.2	NA	20.6	13.4	15.2	14.6	18.2	18.8	20.3	16.1	21.8	15.9
25-Jul	16.3	15.5	NA	20.7	13.4	15.5	14.3	18.7	18.4	20.4	15.6	20.5	16.5
26-Jul	15.3	15.5	NA	21.1	13.7	15.0	14.6	18.2	19.2	19.5	15.6	19.7	17.5
27-Jul	13.5	16.4	NA	21.2	14.8	15.0	15.0	17.0	20.1	19.0	16.6	18.0	18.5
28-Jul	13.3	17.5	NA	21.0	15.2	15.1	14.3	16.4	20.2	19.4	17.4	18.9	19.1
29-Jul	13.1	17.7	NA	20.6	14.9	15.0	13.3	15.7	20.0	19.9	17.4	18.2	18.8
30-Jul	12.3	16.3	NA	20.6	14.0	16.0	13.1	15.3	20.3	20.2	16.5	16.1	18.0
31-Jul	13.6	15.4	NA	20.5	13.5	17.2	13.6	14.2	20.7	19.7	16.1	14.4	17.6
01-Aug	14.0	14.5	NA	20.1	14.0	16.8	14.2	13.4	20.7	19.4	16.3	15.9	17.6
02-Aug	13.8	14.0	NA	20.4	14.9	15.8	13.9	13.1	20.1	19.8	16.0	16.4	18.0
03-Aug	14.7	13.4	NA	20.7	16.4	16.2	14.3	13.3	19.4	19.6	16.2	15.0	17.4
04-Aug	15.5	12.5	NA	20.2	16.5	17.3	14.3	13.6	19.4	19.6	17.0	15.4	16.9
05-Aug	15.0	13.4	NA	19.4	16.9	18.1	13.7	13.7	19.8	17.6	17.9	14.6	17.2
06-Aug	14.2	14.4	NA	18.8	17.1	18.4	13.8	13.9	18.5	16.4	18.5	15.8	18.2
07-Aug	13.2	15.3	NA	18.9	17.3	18.4	14.0	14.2	18.5	15.6	18.6	15.0	18.7
08-Aug	12.7	16.2	NA	19.0	17.8	17.9	14.2	15.3	18.6	15.7	18.1	16.3	17.6
09-Aug	13.1	16.5	NA	18.1	17.5	17.7	14.8	16.7	18.8	17.2	17.7	16.6	15.9
10-Aug	13.7	16.5	NA	18.4	17.1	17.1	15.6	16.3	18.1	18.4	17.8	15.0	16.2
11-Aug	14.3	16.3	NA	19.8	16.3	16.7	16.2	15.1	17.8	19.7	17.7	16.4	15.9
12-Aug	13.3	16.6	NA	20.0	15.9	16.3	16.9	15.2	16.8	19.9	17.7	16.7	15.7
13-Aug	12.8	17.0	NA	19.9	15.6	15.6	17.8	16.0	17.3	20.3	17.7	17.5	15.4
14-Aug	13.5	16.4	NA	19.6	15.6	15.1	18.2	16.3	18.6	20.8	18.2	16.1	16.0
15-Aug	12.5	15.4	NA	17.4	15.2	15.5	18.2	16.0	18.8	19.7	18.1	16.7	16.5
16-Aug	12.2	13.9	NA	15.2	15.0	16.1	18.2	15.2	19.4	20.4	17.8	16.7	17.1
17-Aug	11.9	14.0	NA	14.5	15.7	16.1	18.5	14.1	19.7	20.7	17.0	16.9	17.1
18-Aug	12.0	13.7	NA	15.2	16.8	15.3	17.8	14.2	19.7	21.0	15.8	17.6	16.8
19-Aug	12.4	13.0	NA	16.1	17.5	14.7	16.5	13.6	18.6	20.9	16.7	17.8	15.0
20-Aug	12.8	13.1	NA	17.1	17.5	13.9	15.5	14.0	16.9	20.3	17.7	17.3	14.9
21-Aug	13.2	14.0	NA	17.5	17.1	14.3	14.1	15.3	17.9	18.1	16.1	15.7	15.2
22-Aug	13.2	15.8	NA	17.3	16.3	15.1	13.7	16.5	16.9	16.7	14.5	17.2	15.4
23-Aug	13.0	16.6	NA	17.4	17.0	16.4	14.2	17.6	15.9	14.9	14.2	16.8	15.8
24-Aug	13.1	17.2	NA	16.7	16.8	17.1	13.6	18.7	13.9	14.3	14.4	14.9	16.0
25-Aug	13.4	17.2	NA	16.7	16.0	17.6	14.0	19.2	14.7	14.4	15.2	15.9	16.3
26-Aug	13.3	16.5	NA	16.9	15.7	15.4	14.6	19.1	14.7	15.5	15.8	15.7	15.0
27-Aug	13.2	16.2	NA	16.9	15.7	14.0	15.3	18.3	15.0	15.2	16.0	NA	14.2
28-Aug	13.2	17.0	NA	17.6	15.7	11.9	15.9	18.4	16.5	15.5	16.5	14.6	12.9
29-Aug	13.2	16.3	NA	17.6	14.6	12.2	15.7	17.8	16.1	14.6	15.7	12.9	13.4
30-Aug	13.3	14.6	NA	16.9	13.3	12.6	15.4	16.8	16.6	13.8	14.4	11.0	14.9
31-Aug	13.3	13.4	NA	16.8	12.4	13.0	15.6	15.4	17.2	13.7	13.5	NA	14.9
01-Sep	13.6	12.9	NA	16.1	11.6	12.2	15.3	15.3	16.2	13.4	13.3	NA	15.1
02-Sep	14.0	12.4	NA	15.8	12.0	10.2	13.9	14.2	16.0	11.8	13.5	NA	14.2
03-Sep	14.6	12.1	NA	15.5	12.5	10.0	13.9	13.1	16.8	10.8	13.3	NA	13.8

04-Sep	14.9	12.1	NA	15.4	12.5	10.3	13.3	11.8	NA	11.8	12.2	NA	14.4
05-Sep	13.9	11.5	NA	15.9	12.2	11.0	13.0	11.3	NA	12.0	12.0	NA	13.7
06-Sep	13.6	11.2	NA	15.8	11.6	12.1	12.7	11.0	NA	11.9	12.3	NA	13.0
07-Sep	13.7	11.1	NA	15.6	11.8	11.3	11.9	10.8	NA	12.2	12.8	NA	12.9
08-Sep	14.2	11.4	NA	14.9	11.9	10.7	11.7	10.7	NA	12.4	12.6	NA	12.5
09-Sep	14.7	11.6	NA	14.0	11.6	10.0	11.1	10.6	NA	11.9	NA	NA	11.9
10-Sep	14.7	12.6	NA	15.0	11.0	9.1	11.3	10.9	NA	10.8	NA	NA	13.0
11-Sep	14.6	13.3	NA	14.7	10.6	8.4	11.0	11.6	NA	10.9	NA	NA	13.9
12-Sep	14.4	13.3	NA	15.1	10.6	9.1	12.2	NA	NA	10.6	NA	NA	14.0
13-Sep	13.9	13.1	NA	14.3	10.9	9.9	NA	NA	NA	10.3	NA	NA	11.2
14-Sep	13.5	11.8	NA	13.4	11.2	10.0	NA	NA	NA	10.7	NA	NA	11.0
15-Sep	13.5	10.9	NA	13.0	11.9	11.3	NA	NA	NA	10.7	NA	NA	10.5
16-Sep	12.9	10.3	NA	13.1	12.9	11.7	NA	NA	NA	9.9	NA	NA	8.7
17-Sep	12.4	9.6	NA	13.1	12.7	13.0	NA	NA	NA	NA	NA	NA	8.7
18-Sep	11.8	9.7	NA	12.4	12.7	13.0	NA	NA	NA	NA	NA	NA	8.0
19-Sep	10.7	9.0	NA	12.1	12.8	12.0	NA	NA	NA	NA	NA	NA	NA
20-Sep	10.1	8.1	NA	11.7	13.3	11.2	NA	NA	NA	NA	NA	NA	NA
21-Sep	9.7	7.7	NA	11.4	13.5	9.3	NA	NA	NA	NA	NA	8.8	8.3
22-Sep	9.6	7.0	NA	11.2	13.7	8.0	NA	NA	NA	NA	NA	8.7	9.3
23-Sep	10.2	6.8	NA	12.7	13.3	7.2	NA	NA	NA	NA	NA	10.5	8.9
24-Sep	11.0	6.7	NA	12.8	11.3	8.0	NA	NA	NA	NA	NA	10.8	7.9
25-Sep	11.1	8.1	NA	11.1	9.7	7.3	NA	NA	NA	NA	NA	11.1	9.2
26-Sep	11.1	9.3	NA	11.1	8.4	9.3	NA	NA	NA	NA	NA	12.2	10.3
27-Sep	11.0	10.8	NA	10.6	7.5	9.5	NA	NA	NA	NA	NA	12.1	9.7
28-Sep	11.4	10.6	NA	9.7	6.4	9.6	NA	NA	NA	NA	NA	11.8	8.4
29-Sep	10.8	8.6	NA	10.1	6.7	9.9	NA	NA	NA	NA	NA	11.3	6.5
30-Sep	NA	NA	NA	10.4	6.8	10.4	NA	NA	NA	NA	NA	10.6	5.9

Table A8. Daily mean temperature data for Nechako River at Prince George (NR5) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	NA	NA	12.0	18.2	11.1	13.8	NA	11.1	15.1	NA	15.9	22.8	13.0
02-Jun	NA	NA	12.2	17.9	11.9	14.6	NA	11.4	14.6	NA	15.5	22.8	13.8
03-Jun	NA	NA	12.2	18.0	12.3	15.3	NA	12.0	14.6	NA	15.5	22.3	14.7
04-Jun	NA	NA	11.7	17.9	12.4	15.8	NA	12.3	15.0	NA	15.7	21.9	15.3
05-Jun	NA	NA	11.1	18.1	12.4	15.8	NA	12.2	16.0	NA	16.1	22.1	14.1
06-Jun	NA	NA	11.6	18.3	12.3	15.6	NA	11.8	16.7	NA	15.8	22.1	13.7
07-Jun	NA	NA	11.6	18.4	12.3	15.5	NA	11.2	17.5	NA	16.0	22.3	13.8
08-Jun	NA	NA	11.7	18.8	11.9	14.7	NA	10.7	18.3	NA	16.6	22.5	13.8
09-Jun	NA	NA	12.2	19.1	11.8	15.3	NA	11.4	17.9	NA	17.5	22.9	14.1
10-Jun	NA	NA	12.9	18.8	12.2	15.2	14.2	12.4	17.8	NA	17.7	23.8	13.8
11-Jun	NA	NA	13.7	18.6	13.3	15.0	13.9	13.4	18.1	NA	17.0	24.5	13.1
12-Jun	NA	NA	13.7	18.0	14.5	14.6	14.1	14.2	17.9	NA	16.2	23.5	13.1
13-Jun	NA	NA	13.8	18.0	15.1	14.5	14.7	15.3	17.5	NA	15.9	25.1	13.2
14-Jun	NA	NA	14.2	17.4	15.4	14.4	15.0	16.3	16.8	NA	16.3	21.7	13.1
15-Jun	NA	13.0	14.5	16.7	15.7	14.3	15.3	17.3	16.3	NA	16.5	18.5	13.1
16-Jun	NA	12.6	14.6	16.6	15.9	14.2	14.8	17.6	16.5	NA	16.7	18.0	13.7
17-Jun	NA	12.3	14.5	16.7	15.9	14.6	15.0	17.1	16.9	NA	16.8	17.7	13.6
18-Jun	NA	12.0	14.4	17.0	15.6	15.3	15.6	16.1	17.2	NA	16.9	17.6	13.9
19-Jun	NA	12.3	14.3	17.8	15.7	15.4	16.2	15.4	16.8	NA	17.1	17.5	13.6
20-Jun	NA	12.9	14.1	18.4	15.8	15.3	16.6	15.5	16.4	NA	17.4	17.7	13.4
21-Jun	NA	13.5	14.1	19.5	16.0	15.2	17.0	16.3	16.0	NA	18.1	17.6	12.7
22-Jun	NA	13.6	14.2	19.9	15.2	15.1	16.9	16.9	15.9	NA	17.3	17.6	13.6
23-Jun	NA	14.2	14.3	19.4	15.0	14.8	16.7	17.1	16.2	NA	17.1	17.5	13.5
24-Jun	NA	14.6	14.1	18.6	15.1	15.2	16.5	16.8	16.6	NA	17.2	17.9	13.4
25-Jun	NA	14.8	14.3	18.4	15.5	16.1	15.9	17.2	17.1	NA	17.3	18.8	13.3
26-Jun	NA	15.1	14.1	18.2	15.5	17.2	15.9	17.2	17.6	NA	17.5	19.8	13.5
27-Jun	NA	15.2	13.8	18.6	15.4	17.9	15.8	16.9	17.7	NA	17.7	20.4	13.8
28-Jun	NA	15.5	13.9	18.9	15.2	18.9	15.8	16.4	17.9	NA	17.9	20.4	13.9
29-Jun	NA	15.6	14.4	19.5	14.8	18.7	16.1	16.3	18.3	NA	18.1	19.8	14.0
30-Jun	NA	15.6	14.7	19.8	14.9	17.7	16.6	16.2	18.0	21.1	18.4	19.5	14.0
01-Jul	NA	16.1	15.0	19.9	14.6	17.0	17.1	15.3	17.3	21.1	18.3	19.8	14.2
02-Jul	NA	15.8	15.2	20.0	14.4	16.2	17.3	14.2	16.1	20.4	17.3	20.6	14.4
03-Jul	19.4	15.6	15.7	20.6	14.6	15.2	17.9	13.6	15.6	19.9	17.0	21.5	14.7
04-Jul	18.4	15.6	16.1	21.2	14.8	15.2	18.1	13.5	15.7	19.6	16.6	22.1	14.9
05-Jul	18.5	15.3	16.7	21.4	14.7	15.5	17.8	13.5	16.0	19.4	16.5	22.4	15.1
06-Jul	18.9	15.0	16.5	21.5	15.1	16.2	17.4	13.8	16.6	19.4	16.7	21.9	15.0
07-Jul	19.4	15.3	16.2	21.3	15.4	16.8	17.2	14.4	17.0	18.5	16.9	21.0	15.0
08-Jul	19.9	16.1	15.9	21.0	15.8	17.0	17.3	14.8	17.1	17.4	17.0	20.4	15.3
09-Jul	20.1	16.6	15.9	21.2	16.0	17.1	17.9	15.4	17.6	17.1	16.6	20.1	15.3
10-Jul	20.0	16.5	16.1	21.5	17.1	17.8	17.9	16.1	18.3	18.0	16.5	19.7	15.5
11-Jul	18.9	16.2	16.5	20.9	17.6	18.0	17.5	16.9	19.0	18.4	16.8	19.1	16.0
12-Jul	18.5	16.7	16.7	20.0	17.8	18.3	17.5	17.3	19.6	18.8	17.1	18.7	16.4
13-Jul	18.1	17.2	16.6	19.2	18.0	18.0	18.1	17.1	19.2	19.3	17.3	18.3	16.9
14-Jul	18.0	17.6	16.6	18.7	17.5	17.1	18.3	17.2	19.1	19.8	17.1	17.8	16.8
15-Jul	18.0	17.7	16.6	18.7	16.5	16.8	18.0	17.2	19.1	20.4	16.8	18.0	16.9
16-Jul	18.2	17.6	16.6	18.7	16.1	17.0	17.7	17.4	18.9	20.7	16.9	18.1	17.3

17-Jul	18.7	17.0	16.7	18.8	16.5	17.4	17.2	17.3	18.2	20.9	17.4	18.2	17.1
18-Jul	19.4	16.3	17.1	18.8	17.1	18.2	16.4	17.5	18.1	21.2	17.9	18.5	17.1
19-Jul	20.0	15.8	17.4	18.9	18.0	18.9	16.2	17.8	18.0	21.1	17.7	18.7	17.1
20-Jul	20.5	15.4	17.4	18.9	18.7	19.2	17.0	17.7	18.3	20.6	17.5	18.8	16.8
21-Jul	20.8	15.3	16.9	19.3	19.5	19.4	17.6	17.7	18.8	20.0	17.9	19.7	16.6
22-Jul	20.7	15.8	16.5	19.7	19.4	20.0	18.4	17.8	19.1	20.2	17.9	20.8	16.7
23-Jul	20.3	16.5	16.3	20.4	18.7	19.6	18.8	18.6	19.1	20.6	17.6	21.8	16.5
24-Jul	19.5	17.2	16.2	20.7	17.9	19.4	18.6	19.2	18.5	21.1	17.8	22.1	16.2
25-Jul	18.7	17.9	16.3	20.8	17.7	19.7	18.1	19.7	18.3	20.9	18.1	21.6	15.9
26-Jul	18.4	18.5	16.7	21.1	17.6	19.4	17.9	19.7	18.7	20.2	18.2	21.0	16.1
27-Jul	17.9	18.7	17.1	21.5	17.5	19.1	18.1	19.1	19.2	19.6	18.4	20.4	16.5
28-Jul	17.7	19.0	17.3	21.9	17.1	18.8	17.9	18.7	19.6	20.0	18.5	20.1	16.9
29-Jul	17.2	19.3	17.3	22.2	16.6	18.5	17.6	17.8	19.8	20.6	18.7	19.7	16.8
30-Jul	17.1	19.1	17.0	22.4	16.4	18.8	17.6	16.8	20.2	20.6	18.6	18.7	16.4
31-Jul	17.0	18.3	16.7	22.5	16.5	19.3	17.7	15.9	19.6	20.3	18.2	18.2	16.0
01-Aug	17.2	18.0	16.8	22.3	17.0	18.5	18.0	15.3	19.8	20.3	17.8	17.9	16.0
02-Aug	17.2	17.6	17.0	21.4	17.6	17.8	17.7	15.4	20.2	20.5	17.6	17.7	16.7
03-Aug	17.9	17.3	17.4	21.2	18.1	18.5	17.7	15.2	20.3	20.4	17.5	17.5	16.8
04-Aug	18.0	16.9	17.8	20.8	19.0	19.3	17.4	14.8	20.3	20.2	17.9	17.7	16.8
05-Aug	17.9	16.7	17.9	20.5	19.9	20.2	17.1	14.6	19.7	19.6	18.5	17.6	17.1
06-Aug	17.9	17.0	17.5	19.8	20.7	21.0	17.3	14.7	19.3	19.2	18.6	17.9	17.5
07-Aug	17.1	16.9	17.1	19.4	21.1	21.1	17.2	15.1	18.9	18.7	18.3	18.0	17.7
08-Aug	17.0	17.2	17.0	18.8	20.8	20.7	17.3	15.9	18.6	18.6	18.5	17.8	17.3
09-Aug	17.1	17.4	17.4	18.4	20.3	20.4	17.6	16.7	18.6	19.1	18.4	17.6	16.7
10-Aug	17.5	17.6	17.7	18.5	20.0	19.4	18.3	16.3	19.0	19.6	18.3	17.8	16.5
11-Aug	17.6	17.6	17.9	18.6	19.2	18.9	18.9	15.7	19.4	20.4	18.5	17.9	16.7
12-Aug	17.4	17.5	18.0	18.6	18.6	18.3	19.3	15.9	19.8	20.8	19.0	17.7	16.3
13-Aug	17.2	17.4	18.0	19.1	18.3	18.3	19.8	16.4	19.3	21.0	19.4	18.1	15.4
14-Aug	16.9	17.6	17.7	19.4	18.2	18.0	19.8	16.8	18.8	21.3	20.0	18.5	15.4
15-Aug	16.1	17.7	17.3	18.7	18.5	18.3	20.2	16.7	18.8	21.6	19.6	17.8	15.9
16-Aug	16.0	17.4	17.1	18.4	18.4	18.4	20.5	16.4	18.7	21.7	18.5	17.9	16.6
17-Aug	15.7	16.6	17.2	17.9	18.4	18.3	20.5	16.3	19.1	21.5	17.8	18.2	16.9
18-Aug	15.8	16.3	17.3	17.5	18.7	17.9	19.7	16.2	19.8	21.6	17.0	18.6	16.5
19-Aug	15.9	15.9	17.4	17.7	18.8	17.3	18.7	16.7	20.0	21.7	17.8	18.4	15.9
20-Aug	16.3	15.4	17.3	18.4	19.0	16.5	18.2	16.5	19.8	21.4	18.3	18.4	15.7
21-Aug	16.8	15.1	17.3	19.1	19.1	16.2	17.5	16.5	19.3	20.6	17.9	18.4	15.8
22-Aug	16.4	15.0	17.2	19.2	18.5	16.1	17.2	16.9	18.3	19.2	17.0	18.1	15.8
23-Aug	15.7	15.3	17.1	18.9	18.1	16.3	16.9	17.3	17.7	17.8	16.5	18.0	16.2
24-Aug	15.4	15.9	17.1	18.3	17.3	16.7	16.7	18.0	17.5	16.6	16.7	17.7	16.1
25-Aug	15.6	16.7	17.0	17.9	16.6	16.9	16.6	18.7	17.4	16.5	17.2	17.4	16.2
26-Aug	15.7	17.3	16.7	17.5	15.8	16.4	16.2	18.9	16.6	16.8	17.6	18.0	15.7
27-Aug	15.9	17.4	16.4	17.2	15.9	15.6	16.3	19.0	15.9	16.8	17.8	18.1	15.3
28-Aug	16.2	17.3	16.1	17.3	16.1	14.8	16.4	18.8	15.9	16.8	17.4	17.9	15.2
29-Aug	16.1	17.6	15.9	17.6	15.6	14.7	16.7	18.6	16.0	16.7	17.0	17.3	15.5
30-Aug	16.0	17.4	15.7	17.4	14.8	14.2	16.9	17.8	16.2	16.6	16.1	16.5	15.4
31-Aug	15.9	16.8	15.7	17.5	14.7	14.1	17.1	16.8	16.6	16.6	15.8	15.7	15.5
01-Sep	16.1	15.9	15.7	18.1	14.3	13.0	16.9	16.4	17.2	16.0	15.6	15.8	15.6
02-Sep	16.7	15.1	15.8	18.2	15.0	12.3	15.9	15.7	17.6	15.9	15.3	16.3	15.7
03-Sep	17.5	14.7	15.7	16.6	15.3	11.9	15.1	14.9	17.6	16.0	15.0	16.6	15.7
04-Sep	17.9	13.8	15.5	15.5	14.9	11.9	14.4	14.2	17.1	16.1	14.9	17.1	15.6
05-Sep	17.9	13.4	15.2	15.5	14.5	12.9	14.0	13.5	16.8	15.7	14.9	17.5	15.3
06-Sep	17.8	13.3	14.9	15.4	14.3	13.3	14.1	13.2	17.2	15.5	14.6	17.4	14.8

07-Sep	17.8	12.5	14.8	15.1	14.3	13.5	13.5	13.1	17.4	15.1	15.2	17.1	14.2
08-Sep	17.8	12.7	15.0	14.9	14.0	13.2	13.6	13.4	17.2	14.5	15.2	16.9	14.1
09-Sep	17.9	13.1	15.1	14.3	13.5	12.9	12.8	13.2	16.9	13.1	14.6	16.5	14.5
10-Sep	18.0	13.2	15.0	14.2	13.5	12.2	12.6	13.2	16.5	12.3	14.1	15.9	15.1
11-Sep	17.2	13.9	14.7	14.7	13.5	11.7	12.1	13.2	16.0	11.5	13.6	15.5	15.5
12-Sep	17.0	13.8	14.4	14.4	13.9	11.4	12.0	13.6	15.7	11.4	13.8	13.8	15.5
13-Sep	16.4	NA	13.8	13.9	14.2	11.5	12.6	13.8	15.2	11.4	13.9	9.9	15.0
14-Sep	15.6	NA	13.4	13.4	14.3	12.1	13.2	13.9	14.2	11.8	14.1	7.4	14.8
15-Sep	15.5	NA	13.0	12.5	13.7	13.2	13.9	13.9	13.8	11.8	14.3	7.6	14.6
16-Sep	15.0	NA	12.5	12.6	13.7	13.6	14.3	14.1	13.0	11.8	13.7	5.7	14.6
17-Sep	14.5	NA	12.2	12.8	14.1	14.1	14.6	NA	12.7	11.8	13.6	7.2	13.5
18-Sep	13.9	NA	12.2	12.6	14.5	13.9	14.5	NA	12.3	11.2	13.4	10.4	12.2
19-Sep	13.1	NA	12.5	12.2	14.3	13.2	13.7	NA	11.2	10.6	12.6	11.3	12.3
20-Sep	12.4	NA	12.8	12.1	14.0	12.7	13.4	NA	10.5	10.0	11.9	8.7	12.4
21-Sep	11.9	NA	13.0	12.5	13.7	11.4	NA	NA	10.3	10.0	11.5	8.8	12.3
22-Sep	11.9	NA	13.2	12.6	12.5	10.4	NA	NA	10.5	10.4	11.1	8.6	12.1
23-Sep	12.4	NA	13.3	12.4	11.7	10.2	NA	NA	10.5	10.8	10.8	12.2	12.0
24-Sep	12.9	NA	13.4	12.3	10.9	10.4	NA	NA	10.2	11.3	10.6	12.5	11.3
25-Sep	13.1	NA	13.2	12.0	10.0	10.9	NA	NA	10.7	11.6	10.8	12.5	10.9
26-Sep	13.2	NA	13.1	11.5	8.9	11.4	NA	NA	10.6	11.4	11.3	12.9	11.5
27-Sep	13.7	NA	12.7	11.7	8.7	11.5	NA	NA	10.2	11.4	10.6	13.2	11.6
28-Sep	13.4	NA	12.2	11.3	8.7	11.7	NA	NA	10.5	11.4	10.7	13.3	10.9
29-Sep	13.0	NA	11.9	10.7	7.9	11.9	NA	NA	10.8	10.8	10.7	13.1	10.0
30-Sep	12.7	NA	11.4	11.1	8.2	11.3	NA	NA	11.3	10.2	10.3	12.5	9.3

Table A9. Daily mean temperature data for Stuart River at Fort St. James (SR113) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	NA	NA	NA	16.5	9.0	12.6	10.6	NA	12.8	12.8	16.8	15.6	13.2
02-Jun	NA	NA	NA	16.3	10.5	12.5	10.6	NA	12.8	13.0	16.5	15.5	14.7
03-Jun	NA	NA	NA	16.3	10.7	12.8	11.1	NA	12.8	13.4	16.1	15.1	14.8
04-Jun	NA	NA	NA	15.2	10.3	11.8	11.9	NA	13.1	13.4	16.1	15.2	14.4
05-Jun	NA	NA	NA	15.4	10.0	11.4	12.1	NA	14.0	13.5	15.4	14.9	14.1
06-Jun	NA	NA	NA	15.1	10.3	13.0	12.5	NA	14.5	13.6	15.4	15.0	13.7
07-Jun	NA	NA	NA	15.2	10.1	13.6	12.9	NA	14.8	13.8	16.0	15.7	14.6
08-Jun	NA	NA	NA	16.0	10.5	13.2	13.0	NA	15.4	14.4	16.5	16.2	14.6
09-Jun	NA	NA	NA	16.6	10.4	13.1	12.3	NA	15.5	14.4	16.5	16.6	14.1
10-Jun	NA	NA	NA	17.0	10.7	12.9	11.7	NA	15.6	14.5	16.8	17.8	13.9
11-Jun	NA	NA	NA	16.4	11.0	12.9	11.4	NA	15.3	15.3	16.2	17.1	14.0
12-Jun	NA	NA	NA	16.2	10.9	12.9	12.2	NA	15.0	15.5	16.0	16.0	13.4
13-Jun	NA	NA	NA	16.0	11.1	12.3	12.7	NA	15.0	15.1	15.8	16.5	12.9
14-Jun	NA	NA	NA	15.9	11.4	12.1	12.5	NA	14.9	14.7	16.0	16.3	13.0
15-Jun	NA	NA	NA	15.4	11.6	11.8	13.0	NA	14.9	14.9	15.8	16.4	12.8
16-Jun	NA	NA	NA	16.3	11.1	12.5	13.2	NA	15.3	15.1	15.3	16.3	13.7
17-Jun	NA	NA	NA	16.2	12.7	12.8	13.4	NA	15.1	15.5	15.0	16.0	14.5
18-Jun	NA	NA	NA	16.1	13.9	13.7	14.0	NA	15.0	15.9	14.8	16.4	14.7
19-Jun	NA	NA	NA	16.5	14.4	13.9	14.7	NA	14.7	16.9	15.7	16.5	14.4
20-Jun	NA	NA	NA	17.3	15.0	13.6	15.4	NA	14.4	16.9	16.6	16.6	14.2
21-Jun	NA	NA	NA	17.6	14.9	13.2	15.3	NA	14.3	19.3	16.6	16.3	14.2
22-Jun	NA	NA	NA	17.8	14.4	13.3	15.2	NA	14.6	18.5	16.7	16.1	14.4
23-Jun	NA	NA	NA	17.9	14.3	13.3	14.9	NA	15.3	18.6	16.5	16.2	14.4
24-Jun	NA	NA	NA	17.7	14.3	13.6	14.9	NA	15.9	18.4	16.5	16.4	14.6
25-Jun	NA	NA	NA	17.5	14.5	14.5	14.4	NA	16.4	21.5	16.8	17.9	14.8
26-Jun	NA	NA	NA	17.6	14.5	15.9	14.6	NA	16.2	21.5	16.2	19.0	14.6
27-Jun	NA	NA	NA	18.0	14.1	15.8	14.3	NA	16.0	20.7	16.1	18.7	15.0
28-Jun	NA	NA	NA	18.4	14.2	15.7	14.3	NA	16.1	20.1	17.0	17.7	15.1
29-Jun	NA	14.8	NA	18.2	13.8	15.9	14.4	NA	16.5	18.6	17.4	17.4	15.2
30-Jun	NA	14.4	NA	18.3	13.8	15.6	14.9	NA	16.4	18.7	17.7	17.8	15.2
01-Jul	NA	14.7	NA	18.5	13.6	15.0	15.3	NA	15.3	19.3	17.6	18.9	15.3
02-Jul	NA	14.7	NA	18.9	13.4	14.5	15.4	NA	14.9	19.1	16.7	19.5	15.4
03-Jul	NA	14.7	NA	19.5	13.4	14.0	16.2	NA	14.8	18.7	16.0	21.2	15.5
04-Jul	18.0	14.6	NA	20.1	13.7	14.4	16.9	NA	14.8	18.3	16.0	21.5	15.7
05-Jul	17.9	14.3	NA	20.0	13.6	14.8	16.3	NA	15.0	18.1	16.1	20.7	15.9
06-Jul	18.5	14.1	NA	20.2	13.9	15.2	15.8	11.9	15.5	17.6	16.1	20.2	16.2
07-Jul	19.3	14.6	NA	19.8	13.8	15.3	15.8	13.0	15.6	17.3	15.9	19.4	16.2
08-Jul	18.9	14.7	NA	19.5	14.4	15.8	16.0	13.5	16.0	16.9	15.8	19.3	16.3
09-Jul	18.7	14.7	NA	20.0	14.7	16.4	16.0	14.0	16.5	16.9	15.5	19.0	16.3
10-Jul	17.4	14.8	16.7	20.1	15.8	16.7	15.9	13.9	16.9	16.8	15.5	18.6	16.3
11-Jul	16.6	14.9	16.6	19.7	17.0	16.4	16.2	14.3	17.3	17.2	16.0	18.1	17.0
12-Jul	16.2	15.1	19.6	19.1	17.0	16.4	16.1	14.9	18.2	17.5	15.8	17.9	17.8

13-Jul	16.1	16.1	17.0	18.4	16.1	16.3	16.2	15.9	18.5	17.3	16.2	17.7	17.6
14-Jul	16.1	16.8	17.8	17.7	15.9	15.8	16.4	15.8	18.1	18.0	16.1	17.4	19.5
15-Jul	16.4	16.2	17.6	17.5	15.4	15.8	16.3	15.5	17.9	18.9	16.0	17.1	19.8
16-Jul	16.9	16.2	17.4	17.0	15.1	16.0	15.7	15.8	17.6	19.7	16.2	17.4	19.3
17-Jul	17.2	15.8	17.8	16.7	15.4	16.3	15.5	16.3	16.9	20.1	16.8	17.1	18.6
18-Jul	18.3	15.6	17.8	17.9	16.3	17.0	15.4	16.8	16.7	20.8	17.0	17.2	18.5
19-Jul	18.9	15.4	17.7	18.2	17.9	17.8	15.5	16.7	16.8	20.2	17.1	17.3	18.0
20-Jul	20.0	14.6	17.7	17.9	19.2	18.1	15.9	16.5	17.0	19.5	16.6	17.8	17.8
21-Jul	20.2	14.5	17.4	18.6	19.0	18.6	16.6	16.8	17.1	19.4	16.8	18.9	17.7
22-Jul	20.5	15.0	17.3	19.6	18.1	18.4	17.0	16.7	17.5	20.0	17.2	20.0	17.7
23-Jul	19.7	15.8	17.2	19.5	17.5	18.5	17.1	17.5	17.5	20.7	17.0	21.2	17.5
24-Jul	18.6	16.7	17.3	20.0	17.0	18.4	16.7	18.2	17.0	19.9	16.9	21.4	16.6
25-Jul	18.3	16.4	17.1	20.4	16.4	18.5	16.9	18.5	17.2	19.0	17.1	21.0	16.3
26-Jul	18.3	17.2	17.7	20.6	16.4	18.6	17.4	18.7	17.9	18.3	17.3	20.9	16.9
27-Jul	17.6	17.8	17.0	21.4	15.9	18.2	17.7	18.0	18.6	19.3	17.5	20.0	17.9
28-Jul	17.0	18.0	17.5	21.9	15.9	18.2	17.3	17.3	18.4	19.5	18.1	19.7	17.9
29-Jul	17.1	18.5	17.7	22.0	15.6	18.2	17.3	16.2	18.9	20.0	18.3	19.0	NA
30-Jul	16.8	19.0	17.5	22.1	15.7	18.2	17.3	15.8	19.3	19.8	17.7	18.3	NA
31-Jul	16.6	17.8	18.1	22.6	15.7	17.9	17.0	15.9	19.8	19.5	17.8	17.6	NA
01-Aug	16.9	17.7	18.1	22.4	15.9	17.2	17.0	15.5	19.3	19.7	17.3	17.4	NA
02-Aug	16.7	17.6	18.1	21.4	16.8	17.2	16.9	14.7	18.8	19.7	16.9	17.1	NA
03-Aug	17.0	17.2	18.4	21.5	17.5	18.2	17.1	13.7	18.6	19.6	17.1	16.7	NA
04-Aug	17.3	16.7	18.6	21.6	18.5	19.2	17.1	13.8	18.4	19.7	17.4	17.2	NA
05-Aug	17.1	16.2	19.0	21.1	18.8	19.6	16.8	13.7	17.8	19.4	17.5	17.3	NA
06-Aug	16.8	16.2	19.6	19.8	18.6	20.0	17.0	14.3	18.2	19.2	17.4	17.0	NA
07-Aug	16.6	15.8	18.0	19.5	19.0	20.2	17.0	15.2	18.9	18.9	17.4	16.7	18.5
08-Aug	16.7	16.1	18.0	19.2	20.1	19.7	17.0	15.6	19.2	19.3	17.7	17.2	17.7
09-Aug	16.9	16.4	18.5	19.0	19.9	19.4	17.3	15.5	19.0	19.5	17.9	17.2	17.8
10-Aug	16.7	16.7	18.9	18.9	19.5	18.9	17.6	15.4	18.1	19.6	17.4	16.7	17.5
11-Aug	16.7	16.8	18.6	18.4	18.5	18.7	17.9	15.3	18.3	20.0	18.3	17.5	17.1
12-Aug	16.9	16.5	18.8	18.8	18.0	18.4	18.4	15.6	18.9	20.7	18.6	17.5	16.6
13-Aug	16.8	16.9	19.1	19.2	18.3	18.2	19.2	15.8	19.3	21.2	18.7	17.6	16.0
14-Aug	16.4	17.1	19.5	19.1	18.2	18.2	19.7	16.2	19.4	21.6	18.2	17.4	15.9
15-Aug	15.9	16.9	18.5	18.7	18.0	18.6	19.8	16.0	19.4	21.7	17.3	17.3	16.4
16-Aug	15.9	16.3	18.4	18.2	18.0	18.4	20.4	15.8	19.5	21.9	17.3	17.4	17.2
17-Aug	15.9	15.8	18.5	18.5	17.9	18.0	20.3	16.2	18.9	22.0	17.0	18.2	16.9
18-Aug	15.8	15.6	18.6	18.3	18.1	17.6	19.9	15.9	18.4	22.3	17.2	18.6	16.6
19-Aug	15.8	15.5	18.7	18.3	18.3	17.4	19.1	15.9	17.6	22.5	17.5	18.1	16.8
20-Aug	16.1	15.2	18.6	18.6	18.4	16.7	18.6	16.0	17.4	22.1	17.6	18.2	16.7
21-Aug	16.2	14.8	18.0	18.9	17.7	16.3	18.1	15.9	NA	20.8	17.2	18.2	16.4
22-Aug	15.8	14.8	18.5	18.7	17.1	16.2	17.6	16.0	NA	19.2	16.7	18.2	16.6
23-Aug	15.5	15.2	18.6	18.3	17.1	16.5	16.2	16.6	NA	17.5	16.6	18.1	16.7
24-Aug	15.5	15.6	18.3	18.0	16.7	16.6	15.3	17.4	NA	17.0	16.9	18.1	16.7
25-Aug	15.6	16.0	18.5	17.7	16.3	16.4	15.6	17.9	NA	17.0	16.8	18.1	16.3
26-Aug	15.6	16.4	18.1	17.2	15.4	15.7	15.7	17.7	NA	17.3	17.1	18.3	16.1
27-Aug	15.5	16.1	17.7	16.5	15.4	14.7	15.8	17.7	NA	17.1	16.9	18.2	16.4
28-Aug	15.8	16.4	17.3	16.8	15.6	14.7	15.9	17.4	NA	17.1	16.5	18.1	15.9
29-Aug	15.6	16.8	16.2	17.0	15.0	15.0	16.2	17.3	NA	17.0	16.4	17.1	15.7

30-Aug	15.6	16.6	16.0	16.8	14.7	14.9	16.0	16.9	NA	17.0	16.3	16.4	15.9
31-Aug	15.7	15.6	16.5	17.1	14.5	14.6	16.0	16.0	NA	17.1	15.8	16.0	15.8
01-Sep	15.8	15.0	16.6	17.2	14.5	13.4	15.7	15.5	NA	16.8	15.5	16.4	15.9
02-Sep	16.2	14.8	16.6	17.1	14.6	13.1	15.2	15.3	NA	16.4	15.3	17.0	15.8
03-Sep	16.8	14.3	17.5	16.0	15.1	12.9	14.8	15.0	NA	16.5	15.1	17.3	15.7
04-Sep	17.1	12.9	17.1	15.4	15.2	13.0	14.2	14.4	NA	16.0	14.9	17.4	15.7
05-Sep	17.2	12.4	16.2	15.2	14.9	13.4	14.0	14.5	NA	15.6	14.9	17.5	15.4
06-Sep	16.7	12.6	16.0	15.3	14.4	13.5	13.9	14.4	NA	15.6	14.8	17.4	14.9
07-Sep	17.1	12.6	16.3	15.1	14.1	13.4	13.4	14.1	NA	15.5	15.0	17.1	14.6
08-Sep	17.5	13.0	16.2	15.1	14.0	13.1	13.3	13.7	NA	14.0	14.5	17.7	14.5
09-Sep	17.6	13.1	16.8	14.4	14.0	12.6	12.6	13.5	NA	14.0	NA	17.4	14.8
10-Sep	17.3	13.3	16.3	14.4	13.7	12.6	12.7	13.7	NA	13.7	NA	16.7	15.5
11-Sep	16.4	13.6	16.1	14.6	13.6	12.2	12.9	13.5	NA	13.4	NA	16.2	15.5
12-Sep	16.3	13.8	15.9	14.2	13.7	12.2	13.0	NA	NA	13.1	NA	16.1	15.4
13-Sep	16.0	13.7	15.4	13.7	13.9	12.3	NA	NA	NA	12.7	NA	15.2	15.0
14-Sep	15.9	13.8	14.4	13.8	14.1	12.8	NA	NA	NA	12.6	NA	14.0	15.2
15-Sep	15.9	13.4	14.2	13.0	14.1	12.9	NA	NA	NA	12.6	NA	12.8	14.7
16-Sep	15.6	13.5	14.4	13.5	14.0	13.0	NA	NA	NA	12.5	NA	13.1	14.4
17-Sep	15.1	13.3	13.8	13.6	13.5	13.0	NA	NA	NA	NA	NA	12.7	13.6
18-Sep	13.9	13.2	14.0	13.6	13.8	12.9	NA	NA	NA	NA	NA	13.0	13.3
19-Sep	13.8	12.9	13.6	13.6	14.1	12.3	NA	NA	NA	NA	NA	13.2	12.8
20-Sep	13.6	12.5	14.3	13.4	14.5	12.2	NA	NA	NA	NA	NA	12.7	13.0
21-Sep	13.4	11.9	14.5	13.4	14.4	11.8	NA	NA	NA	NA	NA	12.2	12.6
22-Sep	13.5	11.5	14.2	13.6	14.0	11.4	NA	NA	NA	NA	NA	12.0	12.1
23-Sep	14.0	11.5	14.3	13.1	13.5	11.5	NA	NA	NA	NA	NA	12.5	12.2
24-Sep	14.2	11.3	14.6	12.5	12.6	11.6	NA	NA	NA	NA	NA	12.9	12.2
25-Sep	14.2	10.9	14.3	12.5	11.6	11.7	NA	NA	NA	NA	NA	13.1	11.9
26-Sep	14.4	11.2	NA	12.8	10.7	11.8	NA	NA	NA	NA	NA	13.4	11.9
27-Sep	14.4	11.6	NA	13.0	10.4	11.6	NA	NA	NA	NA	NA	13.5	11.9
28-Sep	14.0	12.3	NA	12.7	9.9	11.9	NA	NA	NA	NA	NA	13.5	11.3
29-Sep	13.5	11.7	NA	12.4	10.3	12.0	NA	NA	NA	NA	NA	13.1	10.7
30-Sep	12.8	11.0	NA	12.4	10.0	11.0	NA	NA	NA	NA	NA	12.8	10.6

Table A10. Daily mean temperature data for Fraser River at Shelley (FR779) from 1995 – 2007. Temperatures are in degrees Celsius. Missing values are indicated with an NA.

Date	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
01-Jun	NA	NA	NA	NA	8.0	10.7	8.4	7.4	NA	9.8	10.0	11.4	10.1
02-Jun	NA	NA	NA	NA	8.5	11.4	8.5	8.1	NA	10.0	9.5	11.6	10.0
03-Jun	NA	NA	NA	NA	8.8	11.8	8.3	8.9	NA	10.8	9.3	11.4	9.9
04-Jun	NA	NA	NA	NA	8.7	11.9	8.7	9.3	9.8	11.8	9.4	10.5	9.8
05-Jun	NA	NA	NA	NA	8.8	11.3	9.0	9.1	10.1	12.3	9.9	10.3	9.2
06-Jun	NA	NA	NA	NA	8.1	10.8	9.5	8.0	11.0	11.6	10.4	10.1	8.9
07-Jun	NA	NA	NA	NA	7.8	9.8	9.7	6.7	11.4	9.9	10.3	10.5	8.4
08-Jun	NA	NA	NA	NA	7.6	8.9	10.0	6.8	11.7	9.6	10.2	11.1	8.0
09-Jun	NA	NA	NA	NA	7.7	8.8	9.9	8.3	11.6	10.2	10.8	12.1	8.4
10-Jun	NA	NA	NA	NA	8.3	9.1	9.7	9.8	11.0	10.8	11.3	12.4	9.0
11-Jun	NA	NA	NA	NA	9.8	9.2	9.7	10.6	10.7	11.2	11.0	12.8	9.2
12-Jun	NA	NA	NA	NA	10.9	9.2	9.9	10.8	10.2	11.2	10.5	13.0	9.2
13-Jun	NA	NA	NA	NA	11.5	9.1	10.6	10.7	10.4	10.6	10.5	13.0	9.2
14-Jun	NA	NA	NA	NA	11.3	9.1	11.4	10.7	10.3	10.0	10.7	13.2	9.2
15-Jun	NA	10.7	14.3	13.5	11.2	9.1	11.3	10.6	10.0	10.0	10.8	13.6	9.7
16-Jun	NA	10.6	14.5	13.0	10.9	9.0	11.3	10.0	10.4	10.3	11.3	13.4	10.2
17-Jun	NA	10.2	14.6	12.9	10.2	9.4	11.4	9.5	10.9	11.0	11.9	12.7	10.8
18-Jun	NA	9.5	14.5	12.7	9.7	10.0	11.7	8.9	11.1	12.1	12.7	12.2	10.9
19-Jun	NA	9.5	14.4	13.3	9.5	9.9	12.2	8.5	11.4	13.3	13.3	12.4	10.2
20-Jun	NA	9.9	14.3	14.6	9.2	9.9	12.5	8.8	11.5	14.0	13.3	12.6	9.7
21-Jun	NA	10.3	14.1	15.4	8.9	9.6	12.6	9.6	11.1	14.3	13.3	12.6	9.7
22-Jun	NA	10.7	14.1	16.3	8.6	9.6	12.4	10.4	10.9	14.8	13.0	12.9	10.1
23-Jun	NA	11.1	14.2	16.5	8.8	9.7	12.1	10.8	10.7	14.8	12.5	13.1	10.3
24-Jun	NA	11.3	14.3	16.3	8.9	10.0	11.6	10.8	11.2	14.5	12.1	13.4	10.1
25-Jun	NA	11.7	14.1	15.9	9.6	10.7	11.0	10.7	12.0	14.3	11.6	14.2	9.7
26-Jun	NA	11.7	14.3	15.5	10.1	12.3	10.9	10.5	12.7	14.3	11.6	15.4	9.9
27-Jun	NA	11.4	14.1	15.3	10.0	12.8	11.1	10.7	12.8	14.2	12.1	16.5	10.9
28-Jun	NA	11.1	13.8	15.1	10.0	13.0	11.4	10.8	12.7	13.9	12.9	16.3	11.3
29-Jun	NA	10.9	13.9	15.7	10.0	12.8	11.8	10.3	13.1	14.1	13.4	15.6	11.5
30-Jun	NA	10.9	14.3	15.6	9.9	11.8	11.7	10.0	13.1	14.4	13.4	15.6	11.6
01-Jul	NA	10.8	14.7	15.4	9.6	10.9	12.5	9.6	12.5	15.1	13.3	15.8	11.5
02-Jul	15.6	10.7	15.0	15.4	9.5	10.2	12.6	9.3	11.9	15.1	12.5	16.3	11.5
03-Jul	15.0	10.7	15.2	16.2	9.8	9.6	13.4	9.7	11.0	14.4	12.0	17.0	11.3
04-Jul	14.5	10.8	15.7	NA	10.1	9.0	13.6	9.7	10.5	13.7	11.6	17.3	11.5
05-Jul	14.3	10.5	16.1	NA	10.1	9.4	13.4	9.7	10.7	13.2	11.8	17.4	12.3
06-Jul	14.4	9.8	16.7	NA	10.1	10.6	13.2	10.0	11.3	NA	12.2	17.2	12.5
07-Jul	14.6	9.5	16.5	NA	10.2	11.3	13.2	10.7	11.7	NA	12.1	16.5	12.7
08-Jul	14.9	10.4	16.2	NA	10.2	11.5	13.4	11.3	12.2	NA	11.8	16.1	12.7
09-Jul	14.8	11.6	15.9	NA	10.7	11.8	13.5	11.8	12.9	NA	11.3	15.7	12.4
10-Jul	14.9	12.1	15.9	16.6	10.8	11.9	13.8	12.5	13.4	NA	11.3	15.0	12.4
11-Jul	14.7	11.8	15.8	16.7	11.3	12.0	14.3	13.1	14.2	NA	11.6	14.2	12.8
12-Jul	13.9	11.9	16.1	16.3	12.0	12.2	14.5	13.9	14.8	NA	11.9	13.7	13.8
13-Jul	13.5	12.5	16.5	15.8	12.0	12.1	14.8	13.6	15.2	NA	12.5	13.6	14.5
14-Jul	13.6	13.3	16.7	15.4	12.0	12.0	14.9	13.7	14.8	NA	12.6	13.2	14.8
15-Jul	13.6	13.5	16.6	15.6	11.8	12.2	14.8	13.5	14.3	15.4	12.5	13.0	14.7
16-Jul	14.3	13.2	16.6	15.2	11.8	12.2	14.4	13.1	14.1	16.5	12.3	13.1	14.5
17-Jul	15.2	12.6	16.6	15.1	11.5	12.1	14.0	13.1	13.8	16.8	12.6	13.3	14.2

18-Jul	15.7	11.9	16.6	15.7	12.0	12.6	13.1	13.3	13.6	17.2	13.1	13.7	13.8
19-Jul	16.6	11.5	16.7	16.2	13.2	13.5	11.9	13.4	13.8	NA	13.1	14.0	13.4
20-Jul	17.2	11.1	17.2	15.7	14.2	14.0	11.0	13.0	14.5	NA	13.1	14.8	13.4
21-Jul	17.1	10.5	17.4	15.6	14.7	14.4	11.1	12.7	15.2	NA	13.2	15.8	13.0
22-Jul	17.1	10.7	17.4	16.1	14.2	14.8	12.0	13.0	15.7	NA	13.5	17.1	12.8
23-Jul	16.9	11.3	16.9	16.8	13.5	14.5	12.8	13.9	15.8	NA	13.4	18.2	12.8
24-Jul	16.1	12.4	16.5	17.5	13.0	14.3	13.0	15.2	15.8	NA	13.2	18.6	12.6
25-Jul	15.5	13.5	16.3	18.1	12.7	14.5	13.1	15.9	16.0	NA	12.8	18.3	12.6
26-Jul	14.7	14.4	16.2	18.3	12.2	13.9	13.4	15.7	16.2	NA	13.6	17.5	13.1
27-Jul	13.4	15.1	16.3	18.6	12.0	13.4	13.4	15.2	16.5	NA	13.9	16.6	13.6
28-Jul	12.7	15.4	16.7	18.9	12.1	13.5	13.1	14.8	16.6	NA	13.9	16.0	14.4
29-Jul	12.5	15.6	17.1	19.0	11.7	13.8	12.7	14.2	16.8	17.2	14.2	15.6	14.8
30-Jul	12.2	15.4	17.3	18.8	10.9	13.9	12.5	13.4	17.1	NA	14.3	14.7	14.7
31-Jul	12.3	14.7	17.3	18.5	11.0	13.9	12.7	12.5	17.3	NA	14.3	14.3	14.3
01-Aug	12.2	13.8	17.0	18.2	11.7	13.5	12.8	11.9	17.4	NA	14.1	14.2	14.1
02-Aug	12.3	13.4	16.7	17.5	12.6	13.4	13.0	11.7	16.9	NA	13.5	NA	14.2
03-Aug	12.2	13.2	16.8	17.0	13.4	14.3	13.0	11.7	16.2	NA	13.1	NA	14.1
04-Aug	12.5	12.8	17.0	16.8	14.4	14.7	13.4	11.9	16.2	NA	13.6	14.0	14.0
05-Aug	12.5	12.5	17.4	16.9	15.3	15.0	13.2	12.1	15.9	17.2	14.2	13.8	14.3
06-Aug	12.8	12.6	17.8	16.6	15.8	15.9	12.8	12.3	15.8	16.2	14.7	14.1	15.0
07-Aug	12.8	12.6	17.9	16.3	15.4	16.2	12.5	13.0	16.0	16.0	14.9	14.0	15.0
08-Aug	12.6	12.8	17.5	15.9	15.4	16.1	12.8	13.9	16.0	14.9	15.4	14.3	14.6
09-Aug	12.7	13.5	17.1	15.6	15.1	15.9	13.6	14.6	16.0	14.7	15.4	14.3	14.2
10-Aug	13.1	14.5	17.0	15.7	14.9	15.2	14.2	14.6	15.4	15.2	15.4	14.0	14.1
11-Aug	13.4	15.0	17.4	15.8	14.6	14.9	14.7	14.0	15.1	15.6	15.5	14.5	14.2
12-Aug	13.3	15.1	17.7	15.9	14.1	14.4	15.2	13.8	15.4	16.6	15.9	14.7	13.8
13-Aug	13.3	15.1	17.9	16.3	14.2	14.1	15.8	14.5	15.0	17.3	15.9	14.9	13.3
14-Aug	13.2	15.0	18.0	16.4	14.2	13.9	16.2	14.7	14.5	17.8	15.9	15.0	13.3
15-Aug	12.8	14.8	18.0	15.9	14.2	14.1	16.5	14.9	14.8	18.0	15.9	15.6	13.7
16-Aug	12.4	14.3	17.6	15.5	14.3	14.3	16.6	NA	15.3	18.1	15.3	15.5	14.6
17-Aug	12.3	13.8	17.3	15.2	14.4	14.4	16.5	NA	15.8	18.0	15.1	15.4	15.1
18-Aug	12.3	13.3	17.1	14.5	14.7	13.9	15.9	NA	16.0	17.8	14.6	15.7	14.9
19-Aug	12.2	12.8	17.2	13.9	15.0	13.6	15.3	NA	15.5	17.6	14.4	15.7	14.6
20-Aug	12.4	12.0	17.3	13.8	15.4	13.4	14.8	NA	14.6	17.5	14.8	15.7	14.1
21-Aug	13.0	11.4	17.4	14.6	15.5	12.8	14.0	NA	14.5	16.7	14.5	15.5	13.9
22-Aug	13.0	11.3	17.3	15.1	15.0	12.6	13.5	NA	14.3	16.0	12.9	15.7	13.8
23-Aug	12.5	12.0	17.3	15.4	14.3	12.6	13.3	NA	13.9	14.7	13.0	15.6	13.8
24-Aug	12.2	12.9	17.2	15.4	13.4	12.9	13.1	NA	13.2	13.5	12.7	15.2	13.9
25-Aug	12.2	13.7	17.1	15.3	12.7	13.2	12.8	NA	12.8	13.2	13.6	15.1	14.0
26-Aug	12.0	14.5	17.1	15.0	11.8	13.0	12.7	NA	13.1	13.1	15.9	15.3	13.6
27-Aug	12.0	14.9	17.0	14.8	11.6	12.2	12.7	NA	13.3	13.6	15.5	15.3	13.2
28-Aug	12.4	14.8	16.7	15.0	12.2	11.2	13.1	NA	13.1	13.4	13.1	15.3	12.8
29-Aug	12.2	14.9	16.4	15.1	11.7	10.8	13.5	NA	13.3	13.6	13.2	14.9	13.1
30-Aug	12.1	14.9	16.1	15.2	11.4	10.3	14.1	NA	13.9	13.0	13.0	14.5	12.8
31-Aug	12.4	14.0	15.9	15.3	11.6	10.2	14.4	NA	14.2	12.8	11.5	13.7	12.8
01-Sep	12.8	12.6	15.7	15.7	11.5	9.9	14.0	NA	13.7	12.1	12.2	13.7	12.5
02-Sep	13.4	11.9	15.7	15.9	11.3	9.2	13.1	NA	NA	11.2	11.9	14.3	12.6
03-Sep	13.9	11.6	15.7	14.7	11.3	9.0	12.3	NA	NA	11.2	11.7	14.7	13.1
04-Sep	14.4	11.0	15.8	13.6	11.6	8.9	11.8	NA	NA	10.9	11.7	15.1	13.3
05-Sep	14.5	10.6	15.7	13.4	11.5	9.3	11.3	NA	NA	10.6	11.6	15.0	12.8
06-Sep	14.3	10.5	15.5	13.3	11.1	9.5	11.3	NA	NA	10.3	11.2	15.2	11.9
07-Sep	14.4	10.5	15.1	13.3	10.9	10.0	11.0	NA	NA	10.2	NA	14.8	11.2

08-Sep	14.7	10.5	14.9	13.2	10.6	9.8	10.7	NA	NA	10.2	NA	14.8	11.1
09-Sep	14.8	10.3	14.8	12.9	10.8	8.9	10.3	NA	NA	9.6	NA	NA	11.2
10-Sep	14.7	10.1	15.0	12.8	10.7	8.3	10.0	NA	NA	8.8	NA	NA	11.4
11-Sep	14.2	10.4	15.1	13.1	10.4	7.9	9.8	NA	NA	8.9	NA	NA	11.6
12-Sep	14.0	10.6	15.0	13.1	10.6	7.9	10.1	NA	NA	8.9	NA	NA	11.6
13-Sep	13.5	NA	14.7	12.8	10.9	8.1	NA	NA	NA	9.0	NA	NA	11.3
14-Sep	13.1	NA	14.3	12.4	11.0	8.7	NA	NA	NA	9.1	NA	NA	11.9
15-Sep	12.8	NA	13.8	11.6	11.1	9.7	NA	NA	NA	9.2	NA	NA	11.9
16-Sep	12.5	NA	13.4	11.5	11.3	10.5	NA	NA	NA	8.9	NA	NA	12.0
17-Sep	12.1	NA	13.0	11.4	11.2	10.9	NA	NA	NA	NA	NA	NA	11.2
18-Sep	11.5	NA	12.5	11.3	11.0	10.9	NA	NA	NA	NA	NA	NA	10.6
19-Sep	10.6	NA	12.2	11.1	11.2	10.7	NA	NA	NA	NA	NA	NA	9.8
20-Sep	10.4	NA	12.2	11.0	11.7	10.4	NA	NA	NA	NA	NA	NA	9.9
21-Sep	10.0	NA	12.5	10.9	11.8	9.5	NA	NA	NA	NA	NA	NA	9.9
22-Sep	9.8	NA	12.8	11.3	11.6	8.4	NA	NA	NA	NA	NA	NA	9.3
23-Sep	9.9	NA	13.0	11.2	11.5	7.9	NA	NA	NA	NA	NA	NA	8.9
24-Sep	10.2	NA	13.2	10.9	10.8	7.6	NA	NA	NA	NA	NA	NA	8.5
25-Sep	10.6	NA	13.3	10.9	9.9	7.7	NA	NA	NA	NA	NA	NA	8.6
26-Sep	10.7	NA	13.4	10.6	9.2	8.0	NA	NA	NA	NA	NA	NA	8.8
27-Sep	10.8	NA	13.2	10.6	8.5	8.3	NA	NA	NA	NA	NA	NA	8.6
28-Sep	10.8	NA	13.1	10.4	7.5	8.8	NA	NA	NA	NA	NA	NA	8.0
29-Sep	10.8	NA	12.7	10.1	7.0	9.4	NA	NA	NA	NA	NA	NA	7.5
30-Sep	10.6	NA	12.2	10.1	6.4	9.1	NA	NA	NA	NA	NA	NA	7.1